Universität Zürich
Institut für Epidemiologie, Biostatistik und Prävention (EBPI)
Direktor: Prof. Dr. Milo Puhan

Betreuung der Masterarbeit: Prof. Dr. Milo Puhan
Leitung der Masterarbeit: Prof. Dr. Milo Puhan

E-Cigarette Taxation in the United States: A Comparison and Health Policy Review Study

Review

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Larissa Merz 12-729-695

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List of abbreviations

BRFSS ..... *Behavioral Risk Factor Surveillance System*
CDC ..... *Center of Disease Control and Prevention*
COPD ..... *Chronic Obstructive Pulmonary Disease*
CTFLA ..... *Coalition for a Tobacco Free Louisiana*
CTP ..... *Center for Tobacco Products*
ENDS ..... *Electronic Nicotine Delivery Systems*
FDA ..... *Food and Drug Administration*
FSPTCA ..... *Family Smoking Prevention and Tobacco Control Act*
HB ..... *House Bill*
HBSC ..... *Health Behaviour in School-aged Children*
HnB ..... *Heat-Not-Burn*
HPT ..... *Health Policy Triangle*
LMG ..... *Lebensmittelgesetz*
LTCP ..... *Louisiana Tobacco Control Program*
LYTS ..... *Louisiana Youth Tobacco Survey*
MATS ..... *Minnesota Adult Tobacco Survey*
MRTP ..... *Modified Risk Tobacco Product*
MYTS ..... *Minnesota Youth Tobacco Survey*
NRT ..... *Nicotine Replacement Therapy*
NYTS ..... *National Youth Tobacco Survey*
RCT ..... *Randomized Controlled Trial*
TabPG ..... *Tabakproduktegesetz*
TFL ..... *Louisiana Campaign for Tobacco-Free Living*
THC ..... *Tetrahydrocannabinol*
TMCA ..... *Tobacco Modernization and Compliance Act*
VAT ..... *Value Added Tax*
WHO ..... *World Health Organisation*
WHO FCTC ..... *WHO Framework Convention on Tobacco Control*

1. Summary

Introduction

While smoking rates in the United States (US) have been declining, vaping rates have been increasing recently. The US begun to regulate e-cigarettes at a federal level in 2016. Still, the number of current e-cigarette users has been increasing, especially since the arrival of JUUL. JUUL has become very popular in particular among the youth. Due to increasing vaping rates and vaping associated deaths, stronger restrictions on both a federal and state level have been enacted, such as restricting available flavours and raising minimum age of sales to 21. Minnesota was the first US state to levy an excise tax on e-cigarettes. Until today more than 20 other states followed, differing widely in their taxation rates and methods. Because Switzerland is lacking behind in regulating e-cigarettes, the goal was to compare different tax policies in the US and elaborate on how vapor products could be taxed in Switzerland.

Methods

Walt and Gilson's (1994) Health Policy Triangle was used as a framework to compare two US states that represent different approaches to e-cigarette taxation. Publicly available data on e-cigarette taxation was reviewed to analyze the Content, Context, Process and Actors.

Results

Whereas Minnesota imposed an excise tax ad valorem on 70 percent of the wholesale price on ENDS and on other tobacco products in 2010, Louisiana imposed a smaller specific tax of five cents per milliliter of nicotine containing liquid as of 2015 along with a tax hike on cigarettes. Minnesota had implemented the tax along with sales restrictions on ENDS and other tobacco products mainly to protect the youth from evolving tobacco products. Louisiana did so mainly for fiscal reasons. The tax on a specific base resulted to be administratively easier.

Conclusion

Further research is needed to evaluate long-term health effects of ENDS and to review their efficacy as a smoking cessation aid. In order to protect minors from nicotine addiction and eventually becoming smokers, a specific tax on a similar level to cigarettes could be considered for Switzerland. Taxes on ENDS should be set high enough to discourage initiation and nicotine addiction among the youth, but on the other hand low enough to encourage switching from more harmful cigarettes. Thus, Switzerland could implement tobacco taxation policies relatively to evidence-based product risks which need to be complemented by further restrictions especially targeting youth protection such as sales, marketing and flavour restrictions to maximize public health benefit and reduce tobacco associated burden of disease.

2. Introduction

E-cigarette sales have risen rapidly and became increasingly popular despite their unknown health risks especially when used over long-term. The first commercially successful version of an electronic cigarette was patented by a Chinese pharmacist called Hon Lik and arrived in the United States (US) in 2006. (1)

Compared to combustible cigarettes, e-cigarettes may be considered to be less harmful because the produced vapor or aerosol does not contain toxins and nitrosamines that are found in conventional tobacco smoke. The act of "smoking" an e-cigarette is called "vaping" and mimics smoking. Therefore, pharmacologically and behaviorally the consumption of these devices can lead to an addiction similar to combustible tobacco products. (2) But as e-cigarettes are relatively new, there is no research on the long-term health effects of their use (3).

Also, it is well known that (substantial) price increases for tobacco products via increased taxes lower smoking prevalence. Still, it is unclear how e-cigarettes should be taxed so that, ideally, the consumption of both tobacco products and e-cigarettes is lowered (4).

There is no harmonized tax for e-cigarettes among EU countries, but the European Commission allows the individual countries to impose excise taxes on e-cigarettes. As of April 2019, several EU countries such as Finland, Portugal, Estonia, Sweden, Slovenia, Hungary, Cyprus, Lithuania, Romania, Greece, Italy, and Latvia had a specific excise tax per milliliter of the e-cigarette liquid, which also exists in other European and Central Asian countries such as Montenegro, Russia, Albania, Georgia, Serbia and Azerbaijan. (4) Currently, Switzerland does not impose an excise tax on e-cigarettes, but the regulation within tobacco product law (TabPG) is currently in process at the Swiss Federal Assembly (5).

Despite the missing federal tax on e-cigarettes in the US, in early 2020, 21 US states and D.C. had enacted taxes for vaping products on a state level (4). Minnesota was the first state to induce a tax in 2010 by extending the legal definition of tobacco products to also include e-cigarettes. (3) The definition of e-cigarettes and similar products affects their regulation, particularly if existing laws for cigarettes apply, including sales and marketing, youth access, smoke-free and taxation laws within a state (6). The US show a federal system similar to Switzerland so that Switzerland could learn from the US experience with different approaches to taxing of e-cigarettes. Another advantage of looking at the US, in opposition to comparing different countries, is that health policies remain comparable to each other due to same legislation process with publicly available data, same currency and language.

After a short introduction about e-cigarettes and other tobacco products in general, their epidemiology, health impact and public health strategies in tobacco prevention, this paper will

mainly focus on the taxes US states have imposed on e-cigarettes, as the price seems to have an important impact on e-cigarette consumption not only among current smokers, but also on its use and initiation among young adults. (7) After a general description on US vaping taxation in comparison to Switzerland, the aim is to retrospectively examine the development of current health policies regarding e-cigarette taxation in two selected US states and its impact on e-cigarette consumption via Walt & Gilson's health policy triangle as an analytical framework and finally to give advice on how new tobacco products such as ENDS could possibly be taxed.

3. Background

3.1. E-cigarettes and Other Tobacco Products

3.1.1. E-cigarettes

Jenssen et al. (8) defined electronic cigarettes as follows:

> *"handheld devices that produce an aerosol from a solution typically containing nicotine, flavoring chemicals, and other additives for inhalation through a mouthpiece by the user (alternative names include "e-cigs, "electronic cigars [or "e-cigars"], electronic nicotine delivery systems, electronic hookah [or "e-hookah"], hookah sticks, personal vaporizers, mechanical mods, vape pens, pod systems, and vaping devices)"*

This definition shows that there exist different products labelled as electronic vaping devices. In the scientific literature they are mostly referred to as "electronic nicotine delivery systems" (ENDS). In this paper, they will be generally referred to as e-cigarette or ENDS synonymously. As they usually contain nicotine (which is derived from the tobacco plant), they are mostly considered as **non-combustible tobacco products**. The classification into combustible and non-combustible tobacco products exists mainly for tax purposes. Combustible products such as conventional cigarettes, cigars and hookahs are burned in order to produce smoke. Non-combustible products include smokeless tobacco products such as chewing tobacco as well as newly developed products such as e-cigarettes and Heat-not-burn products later discussed in this chapter. E-cigarettes are mostly battery-operated. (9)

Since the arrival of the electronic cigarette into the US market from China in 2006, there have been substantial changes in its design and the technology. (9) Despite the wide variability, most products have similar design characteristics including the following components (figure 1):

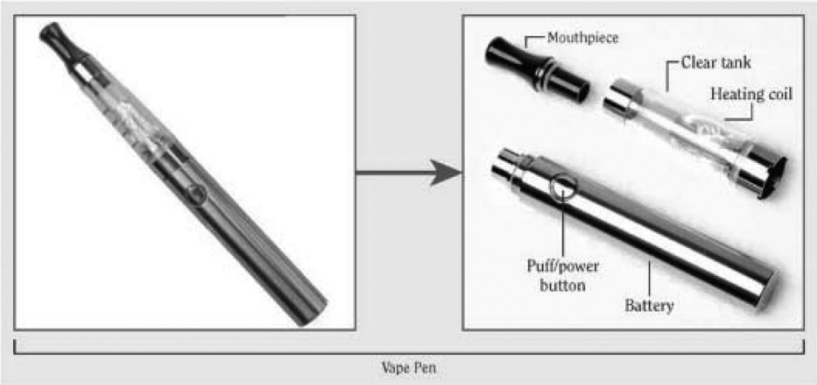

Figure 1 E-cigarette components: vaping pen

(from: Walley SC, Wilson KM, Winickoff JP, Groner J. A Public Health Crisis : Electronic Cigarettes, Vape, and JUUL. Pediatrics. 2019;143(6))

a mouthpiece, a cartridge/reservoir or tank (which may contain nicotine), an atomizer or heating coil, a battery, an indicator light and a sensor or user-actuated button to activate the heating-coil. ENDS use a battery powered heater to turn a liquid which contains nicotine/propylene-glycol and flavouring chemicals into a vapor which is inhaled. When a user inhales from the mouthpiece, the heating-coil aerosolizes the liquid to form an emission, which is best described as an aerosol (fine particles in a gas) but is commonly called vapor. (10)
Nowadays, there is a wide variability of products, often referred to as first-, second-, third- and fourth-generation products (figure 2):

Figure 2 design variability from left to right: a conventional cigarette compared to ENDS from generation 1 to 3

(from: Walley SC, Wilson KM, Winickoff JP, Groner J. A Public Health Crisis : Electronic Cigarettes, Vape, and JUUL. Pediatrics. 2019;143(6))

The first-generation products usually have the appearance of a traditional cigarette ("cigalikes"), are mostly disposable or have a reloadable cartridge for repeated uses, whereas the second-generation is known as vapes or vape pens and have a refillable reservoir for the e-liquid. Third generation e-cigarettes are frequently referred as "mods" or tank systems because they have the possibility to modify the wattage and voltage.
Lately, many products do not resemble traditional tobacco products anymore and rather look like common items such as pens or flashlights and are referred to as fourth-generation e-cigarettes, such as the brand JUUL whose devices are shaped like an USB flash drive. JUUL has recently become very popular among young users and sales have risen rapidly since its launch in 2015 in the US, experiencing the greatest market share of any e-cigarette in the US by the end of 2017 (2,10,11). In Switzerland, JUUL has been available since the sales ban for nicotine containing e-cigarettes has been lifted in 2018 (5).

JUUL is advertising pods containing nicotine salts with high nicotine concentrations of five (59mg/ml) and three percent (35mg/ml) in the US[1] and there used to exist many youth-appealing, sweet flavours. Rather than vaping, JUUL users call the use “JUULing”. One JUUL pod is considered as equivalent to one pack of combustible cigarettes. The high nicotine concentration aims to attract especially current smokers to switch from smoking combustible cigarettes to “JUULing”. At the same time, the high concentrated nicotine can lead to addiction in young people. (10)

In general, the e-liquid containing cartridges or tanks can be either open or closed systems. Open tanks allow the consumer to refill the liquid and therefore allow more freedom in voltage, nicotine levels or even in adding illegal substances. Closed tanks in contrast are normally sold as disposable pods or cartridges, such as the pods from JUUL. Closed tank systems usually have higher nicotine levels per milliliter. (12) Different tank systems and e-cigarette designs can lead to different taxation, which we will be discussed later in chapter 4.

Figure 3 JUUL product design
(from: https://shop.vapsmoke.ch/juul-basic-e-zigaretten-set)

3.1.2. Heated Tobacco Products

Besides, tobacco companies have also developed alternative nicotine products such as so-called **“Heat-not-burn**” (HnB) cigarettes. They were released in 2014 in Switzerland and

[1] In the European Union and in Switzerland in contrast, the nicotine concentrations are regulated more strictly and limited upto ≤ 20mg/ml. This limit also accounts to Hnb products. (19,31)

have been admitted to the US Market by the FDA in 2019 (13). HnB do like their name suggests not burn tobacco (combustible cigarettes burn tobacco at around 800°C) but rather heat it up to 350°C to generate an aerosol containing nicotine which can be inhaled. They are therefore advertised as less harmful than combustible cigarettes. The most famous HnB product is IQOS (acronym: "I Quit Ordinary Smoking") from Philip Morris International and consists of a charger, a holder and tobacco sticks, plugs or capsules, which are inserted into the holder and heated with an electronically controlled heating blade. Similar to e-cigarettes, they are gaining more popularity, however lacking clear evidence about their long-term health effects. (13) Still, the emissions contain substances similar to conventional cigarette smoke like formaldehyd and benzopyren but in lower doses(14). Nevertheless, the FDA just recently authorized the marketing of IQOS as a "Modified Risk Tobacco Product" (MRTP) in 2020, meaning they can be marketed as less harmful in comparison to conventional cigarettes, but only when switching completely to using IQOS. In addition, the FDA states that people who do not use tobacco products should not start using them or other tobacco products. (15)

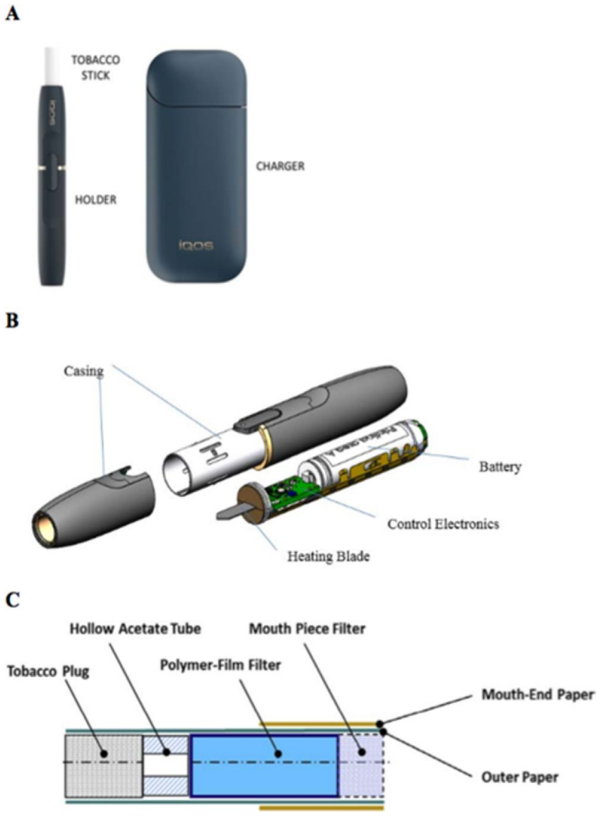

Figure 4 IQOS product design, the most famous HnB product

(from: Glantz SA. Heated tobacco products: the example of IQOS. Tobacco Control 2018;27:1-6.)

3.1.3. Snus

Snus is another non-combustible tobacco product for oral use. It is a pasteurized moist powder tobacco originating from Sweden. It comes in a small pouch and is put under the lip (16). Whereas in the EU, the sales and marketing of Snus is forbidden, it is legal in the US. Snus underlies FDA regulation and is taxed in many US states (mostly as "smokeless" tobacco) but with several different methods. (17) Long-term epidemiological studies showed scientific evidence that when used exclusively instead of smoking, Snus poses a lower risk of several smoking associated diseases. Therefore, the Snus tobacco products by the Brand Swedish Match USA, Inc. sold under the "General" brand name were authorized as the first-ever MRTP by the FDA in October 2019. (12) This allows the manufacturer that the smokeless tobacco will be sold with a product-specific, five years limited, modified risk claim as follows:

> *«Using General Snus instead of cigarettes puts you at a lower risk of mouth cancer, heart disease, lung cancer, stroke, emphysema, and chronic bronchitis.»* (18)

Nevertheless, this does not mean these products are save, but they have FDA approved lower risks compared to combustible tobacco products. In addition, some US states such as North Carolina and Washington have implemented a "modified risk clause" in their tax code[2], resulting in reduced taxes for a MRTP on a state-level. (12,18)

Furthermore, the sale of Snus was forbidden in Switzerland since 1995 but has recently been legalized in June 2019 by the Swiss federal court. Interestingly, Sweden is associated with the lowest smoking rates in Europe as a result of Snus consumption and it is the most often used product as a cessation aid. (12,19–21)

3.2. Smoking and Vaping Epidemiology

3.2.1. US Smoking and Vaping Epidemiology

Cigarette smoking remains the leading cause of preventable mortality in the United States and leads to enormous health care costs due to smoking attributed cancer, cardiovascular, metabolic and pulmonary diseases (especially COPD). Also, smoking during pregnancy can lead to infant deaths.

Despite the decline in the current smoking prevalence, the annual burden of disease of smoking-related mortality in the United States has remained above 400'000 annual deaths for more than a decade and with millions more living with smoking-associated illnesses. This shows the relevance of tobacco control policies. (17,22,23)

[2] https://www.ncleg.gov/EnactedLegislation/Statutes/PDF/ByArticle/Chapter_105/Article_2A.pdf

In 2018, the National Survey of Drug Use and Health (NSDUH) (24) registered 47 million past-month cigarette smokers (aged 12 or older) in the US. The respondents were asked about their tobacco use in 30 days before the interview. Among the 58.8 million current users of any tobacco product, 65.5 percent smoked cigarettes but did not use other tobacco products, 14.4 percent smoked cigarettes and used some other type of tobacco product and 20.1 percent used only other tobacco products than cigarettes. The number of people having smoked cigarettes in the post month was lower in 2018 than from 2002 to 2017. Less than 1 in 6 people were current cigarette smokers in 2018, compared to 1 in 4 people in 2002 to 2008.
The decline in smoking rates especially in teens and young adults since 2002 is likely to be linked to the recent growth in the use of ENDS as a substitute for delivering nicotine. Unfortunately, the NSDUH did not yet ask separate questions about the use of electronic cigarettes to examine the recent trend.
Similarly, the Center of Disease Control and Prevention (CDC) reported a decline in smoking rates from 20.9 percent in 2005 to 13.7 percent in 2018, with the highest smoking rates among people aged 25-44 and 45-64 years, and lowest among people aged 18-24 years. (25)

The National Youth Tobacco Survey (NYTS) which is funded by the FDA and CDC showed that since 2014 e-cigarettes have been the most frequently used tobacco product by the youth in the US and the use is increasing ever since. Between 2011 and 2015, the NYTS revealed an increase in the current use (defined as use on more than one day during the past 30 days) among high school students from 1.5 to 16 percent. In 2018, NYTS even measured a current use among high school students of 20.8 percent, compared to 11.7 percent in 2017. This means a total of over 3 million American high school students have used e-cigarettes in 2018. The NYTS authors hypothesize the increase in e-cigarette use among US high school students to be attributed to the recent growth in the use of JUUL products, which have youth appealing flavours, high nicotine concentrations and an easy and discreet use due to their USB-flash like appearance. In 2019, NYTS reported over 5 million current users of e-cigarettes among US middle and high school students. (26,27)

On December 2018, the Surgeon General of the United States Public Health Service Jerome Adams declared the e-cigarette use among the youth to be a public health epidemic and that action must be taken to protect the youth from health risks and nicotine addiction. (28)
Since March 2019, over 2500 cases of acute lung injury and 60 deaths associated to vaping have been reported all over the US with the majority of cases in young adult males (29).

Around 80 percent of the reported cases of vaping-associated respiratory illness (EVALI: e-cigarette, or vaping, product use associated lung injury) have used tetrahydrocannabinol (THC), which is a psychoactive substance from the marijuana plant, and other cannabinoids containing, often counterfeit e-cigarettes. These lung injuries therefore may be linked with vitamine E acetate found in these THC based cartridges as a diluent, which may be irritant to the airways and lead to an inflammatory cascade within the lungs when inhaled. Refillable cartridges allow the user to add substances like marijuana not intended by the manufacturer. Despite the insufficient evidence of the reasons for these respiratory illnesses, the FDA and CDC recommend not to use THC containing ENDS, not to add any additional substances to the cartridges and not to buy products by informal sources. (28–30)

In addition, the high nicotine concentration can lead to a nicotine addiction and lifelong tobacco use especially in young users. Nicotine is a psychoactive substance and exposure during adolescence can harm the developing brain.

For adults in contrast, ENDS may reduce smoking related morbidity and mortality risks for current smokers if switching completely from smoking combustible cigarettes to ENDS. Many users however report to use e-cigarettes and still smoke (dual use). (10,31,32)

3.2.2. Switzerland's Smoking and Vaping Epidemiology

Only a couple of studies exist investigating the current e-cigarette use in Switzerland. Addiction Suisse (33) mentioned in their international Health Behaviour in School-aged Children (HBSC) study in 2018 that around 50 percent of the 15 year old students had never tried cigarettes nor ENDS in their life. In contrast, 19.9 percent of the boys and 12.1 percent of the girls had tried ENDS at least once in their life, without having tried combustible cigarettes, whereas 4.8 percent of the boys and 7 percent of the girls had tried combustible cigarettes but no ENDS. 30.7 percent of the 15 year old boys and 22.6 percent of the girls hat tried both at least one time in their life. However, Juul has just recently arrived in Switzerland in December 2018. In the HBSC study, classes were sampled randomly as a cluster-sampling and chosen for the survey about the current use of tobacco, alcohol and cannabis among young Swiss students aged 11 to 15 years old.

Suchtmonitoring Schweiz (34) measured in 2016 only 0.4 percent of daily vapors, a weekly use of ENDS of 0.7 percent and a percentage of people ever having used or tried these products of 15.3 percent. The majority of people using ENDS or HnB products were current

smokers (dual use). In addition, 2 percent indicated having tried HnB products, but only 0.2 percent using it daily and 0.3 percent weekly.
Furthermore, according to Bundesamt für Gesundheit (BAG)[3], in 2017, 21.7 percent of the Swiss population older than 15 were current smokers, among 15-24 year olds even 31.7 percent.

3.3. US Tobacco Control History

Tobacco control efforts such as indoor smoke-free laws, media campaigns and imposed taxes led to declining cigarette smoking rates. (35) To understand why the regulation of tobacco products is crucial for smoking prevalence and public health, this chapter will shortly focus on tobacco control history and federal tobacco taxation in the US.
According to the WHO (35), the most effective control tool in reducing tobacco consumption is increasing excise taxes. As a consequence, retail prices will increase and consumption decrease.
The first federal cigarette tax in the US was enacted in 1864 as a measure to Civil War revenue. Therefore, between 1864 and 1983, the federal tax on cigarettes has fluctuated in correspondence to the alternating periods of war and peace and due to the revenue requirements of the government. To finance the Korean War in 1951, there was an increase of the cigarette excise tax from seven to eight cents per pack. It was doubled again in 1984 to 16 cents per pack, then increased to 20 cents in 1992 and 24 cents in 1993. In addition to the excise tax on cigarettes, many states apply general sales taxes to cigarettes. (36) By 2005, the federal cigarette tax had augmented to 37 cents per pack. In 2009, the Federal tobacco excise tax was increased to $1.01 per pack, which is the current federal tax to which the state tax is added.
Average cigarette prices range substantially from $5.25 per packet in Missouri ($1.01 federal and $0.17 state tax) as the state with the lowest price to $12.85 in New York ($1.01 federal and $4.35 state tax) with the highest price per pack. (36,37)
Nowadays there is a wide variety of state excise taxes on cigarettes, giving the consumers the opportunity to shop for bargains across borders and leading to unintended consequences of tax policies (tax avoidance). In 2017, New Hampshire had the highest level of outbound smuggling at 65 percent of consumption (with an excise tax of $1.78 per pack), whereas New York had the highest inbound smuggling activity (with an excise tax of $4.35 per pack) with

[3] https://www.bag.admin.ch/bag/de/home/zahlen-und-statistiken/zahlen-fakten-zu-sucht/zahlen-fakten-zu-tabak.html

55.4 percent of cigarettes consumed in the state estimated to be derived from smuggled sources. (38,39)

To reduce tobacco associated morbidity and mortality in response to the globalization of the tobacco epidemic, the WHO developed an evidence-based international treaty regarding: Price and tax measures to reduce tobacco demand and non-price measures namely protection from tobacco smoke exposure, regulation of contents of tobacco products, packaging and labelling, education, communication and public awareness, advertising, promotion, sponsorship and demand reduction measures concerning tobacco dependence and cessation (40).

These issues were provided by articles 6-14 of the WHO Framework Convention on Tobacco Control (WHO FCTC) which was signed and ratified by 40 states in June 2004 and entered into force in 2005. There are currently 181 parties in the Convention. The WHO developed the **MPOWER** format containing the 6 following components to evaluate the implementation of tobacco control (40,41):

- **M**onitor tobacco use and prevention policies. Articles 20 and 21 of FCTC
- **P**rotect people from tobacco smoke. Article 8 of FCTC
- **O**ffer help to quit tobacco use. Article 14 of FCTC
- **W**arn about the dangers of tobacco. Articles 11 and 12 of FCTC
- **E**nforce bans on tobacco advertising, promotion and sponsorship. Article 13 of FCTC
- **R**aise taxes on tobacco. Articles 6 and 15 of FCTC

In the MPOWER format, taxes are recommended to contribute to a decreased tobacco consumption under article 6 and 15 of WHO FCTC.
Whereas the US and Switzerland have signed the FCTC, both have not ratified it yet (42).

3.4. Federal Tobacco Regulation in the US

The “Family Smoking Prevention and Tobacco Control Act” (FSPTCA) signed into law on June 22, 2009 and gave the U.S. Food & Drug Administration (FDA) the authority to regulate the manufacture, distribution and marketing of “tobacco products” (Public Law 111-31). (43,44) As many e-cigarettes do not contain tobacco itself, but nicotine derived from tobacco, many traditional tobacco-related laws did not apply. Even though there is no federal tax unlike on cigarettes and other tobacco products, a few US states have implemented heavy taxes on vaping devices on a state level. Different states within the US have different approaches to

e-cigarette taxation policy as shown in table 1., chapter 4 (45). Until 2016, e-cigarettes were not regulated at a federal level. In the same year, the FDA finalized a rule to extend their regulatory authority and therefor created the agency "Center for Tobacco Products"' (CTP) to cover all "tobacco products" by extending their definition, including ENDS such as e-cigarettes, vapes, e-liquids, e-cigars, e-pipes and e-hookahs. (43,45) This **deeming rule** also included prohibitions on the sale of covered tobacco products to individuals younger than 18 years among other sales and distribution requirements. In addition, following the deeming rule, manufacturers were required to submit a "premarket review application" for the sale of ENDS. However, the implementation was delayed and is therefore allowing e-cigarettes to remain on the market without premarket review until 2022 (8). As tobacco use is the leading cause of preventable death and diseases in the US, the FDA has implemented education campaigns to increase the public's awareness of the potential health harms caused by the use of these products. (43)

In October 2019, the FDA granted Snus smokeless tobacco of Swedish Match USA, Inc. to be the first-ever product labelled as MRTP. The MRTP was outlined in the FSPTCA in 2009 and allows companies to submit applications for the FDA to examine whether a single, specific tobacco product (and not an entire class of tobacco products) may be sold or distributed to reduce harm or the risk of tobacco-related disease associated with regular marketed tobacco products. This means that specific products with the label MRTP can be marketed as proved to be less harmful relatively to cigarette smoking and change warning label statements. Eight products of the brand "General" Snus of Swedish Match USA, Inc. were the first products labeled as MRTP by the FDA until today. Philipp Morris filed an MRTP application for its HnB tobacco product IQOS in 2016, which was just authorized in July 2020 to be marketed as a MRTP (15). ENDS are another tobacco product for which future modified-risk applications would be likely, given their likely reduced harm-potential. (18,46)
Because research showed that especially flavoured tobacco products appeal to young users, the FSPTCA banned conventional cigarettes with characterizing flavours except tobacco flavour or menthol in 2009 with the FSPTCA. (8,48)
Concerning flavoured ENDS, the FDA finalized an enforcement policy in January 2020 on "unauthorized flavoured cartridge-based ENDS" (other than tobacco or menthol) (48).
The FDA will therefor prioritize enforcement against any flavoured, cartridge-based ENDS without FDA authorization and ENDS where the manufacturer fails to take adequate measures to prevent youth access or targets minors. Manufactures will need to apply for FDA

approval, such as JUUL with its cartridge-based devices which are popular especially among the youth. The menthol flavoured ENDS were not included in this rule, as a national study indicated that the youth preference for tobacco and menthol-flavoured ENDS was much lower than for mint- and sweety, fruit-flavoured products. Loopholes allow flavoured e-cigarettes to still be available, as they come in several different shapes and the policy does not prioritize disposable products or refillable cartridges. (48)
Priorly, on December 20, 2019 the federal minimum age of sale of tobacco products (including cigarettes, cigars, smokeless tobacco, pipe tobacco and e-cigarettes) was raised from 18 to 21 years (referred as "Tobacco 21" legislation) with the goal to limit access especially for high school students (44,48).

Currently, the "Protecting American Lungs Act" (H.R. 2339) has been introduced and passed the House in February 2020 and is being processed to the Senate for consideration. The bill could possibly lead to new restrictions on tobacco and vaping products and their sale in the US by i.a. imposing higher taxes on nicotine (besides if used as a FDA approved NRT), ban further flavoured tobacco products (especially menthol), generally prohibit online sales of tobacco products and ENDS among some more planned restrictions. The bill would impose a new excise tax on nicotine used in ENDS on a federal level. (49,50)

3.5. E-cigarette Regulation in Switzerland

E-cigarette regulation is being discussed controversially in Switzerland. At the moment, they are regulated as a consumer product under food law (LMG).[4] This means that they are available even for minors. E-cigarettes containing nicotine can be sold as long as they satisfy the technical requirements of an EU or EEA country and are legally marketed in one of these countries (Cassis-de-Dijon principle, enacted as of April 24, 2018). (5)
Before, the commercial import and marketing of e-cigarettes containing nicotine and their refill cartridges was not allowed (51). At the moment, the Federal Assembly of Switzerland is formulating a draft law targeting on regulating e-cigarettes as a tobacco product under tobacco law (TabPG[5]) and was estimated to be enacted in 2022, but was postponed due to the Covid-

[4] The Swiss Federal Administrative Court subsumed e-cigarettes under LMG in 2012, arguing that they do not contain tobacco and that there is no combustion process and therefore regulated them under art. 5 LMG lit. b as an article of daily use when not defined as a medical drug(5)
[5] E-cigarettes will be defined as «Gerät, das ohne Tabak verwendet wird und mit dem Dampf inhaliert werden kann, der durch das Erhitzen einer Flüssigkeit mit oder ohne Nikotin gewonnen wird, sowie Nachfüllflüssigkeiten und Kartuschen für dieses Gerät» (Art. 3 lit. f E-TabPG)(5)

19 pandemic to mid 2023. The aim is to regulate e-cigarettes the same way as combustible tobacco products and therefore limit the sales for minors, the marketing (advertising and packaging) and smoke-free policies. Still, since 2018 some Swiss cantons begun to regulate e-cigarette more strictly at a cantonal level. Furthermore, minimum age of sales for cigarettes is regulated on a cantonal level. (51) As there exist no federal limitations to the advertising, promotion and sponsoring regulation of e-cigarettes yet, Switzerland remains currently the country with the weakest regulations within Europe besides Monaco and Andorra (5,52). A current popular initiative in Switzerland therefore aims on forbidding advertisement targeting on children.[6] The future regulation of e-cigarettes (and also HnB products) under tobacco law as tobacco products will further define new product categories as tobacco products "to smoke, to heat and for oral use" (Art. 3 TabPG) and add e-cigarettes as an own product category. Whereas Switzerland signed the WHO FCTC in 2004, it has not been ratified yet. Switzerland will in accordance with established practice not ratify international conventions before having adapted national legislation, meaning TabPG needs revision first to meet FCTC minimum standards, especially regarding limitations on advertising, promotion and sponsorship of ENDS. (53)

Also, due to the Motion Zanetti "Befreiung der elektronischen Zigaretten von der Tabaksteuer" from 2011, Switzerland does currently not levy an excise tax on e-cigarettes. Back then, policymakers were assuming that ENDS might help smokers to quit. Therefore, at the moment Switzerland is only levying the value-added tax (VAT) on ENDS. (19) Current discussions in Switzerland aim on implementing an excise tax on ENDS due to their unknown long-term health effects and increasing consumption among the youth. The amount should acknowledge the reduced harm potential of these devices. Therefore, a lower tax amount than on conventional cigarettes is planned. First, the regulation under TabPG should provide a framework on future e-cigarette use by among other things prohibiting sale to minors on a federal level and regulating advertising more strictly. After, the aim is to implement an excise tax likely leading to a specific tax of around CHF 0.20 per milliliter, a percentage of the whole- or resale price (twelve percent) or a mixed version, considering the nicotine content. (54)

[6] https://kinderohnetabak.ch/initiative/die-initiative/

3.6. Public Health Strategies on E-cigarette Regulation

As e-cigarettes provide an experience similar to smoking combustible cigarettes and deliver nicotine, they may help smokers to quit. The public health debate concerning the regulation of e-cigarettes has focused on increased harm to non-smoking adolescents (and the function as a gateway to long term nicotine addiction) and harm reduction for current smokers (if working as a cessation aid).

There are different approaches on adopting public health policies on tobacco products.

The main goal is to reduce avoidable mortality and morbidity such as cancer, cardiovascular disease, respiratory diseases and infection associated with tobacco use (3).

3.6.1. E-cigarette Regulation Principles

Regulatory approaches for ENDS vary widely. In 2017, E-cigarettes were completely banned in 22 countries such as for example Singapore, Japan, Thailand, Uruguay and Brazil (4).

The WHO FCTC recommended in 2014 that countries allowing the use and sales of ENDS should regulate the use similar to other tobacco products and therefore should restrict among other things: the sale to minors, the advertising, promotion and sponsorship, the taxation, the use of flavours, the laws for the use in indoor spaces and the nicotine concentration (55). Taxation is considered not only to have an impact especially on youth access, but also to generate revenue for the government. (4,40)

Kennedy et al. (56) investigated 68 countries regulating e-cigarettes at a national level, of which 25 enacted new policies to regulate ENDS, 22 used existing regulations, 7 made amendments to existing laws and 14 used a combination of new and existing regulation. Whereas common policies included a minimum age of purchase, the indoor-use and marketing restrictions, fewer countries applied a tax to e-cigarettes. The regulatory approach depends on the legal product classification of ENDS and varies widely from countries defining them as therapeutic medicinal products, as consumer products (such as Switzerland until the updated TabPG) or including/amending them in the definition of a tobacco product.

This thesis will mainly focus on the tax and the impact of prices for tobacco products and the related policies. Considering the price, several strategies must be taken into account regarding policy making.

Hasselt et al. (57) estimated the impact of tax increases in the US from 2001-2011 using data from the NSDUH. They found out that an increased federal cigarette tax was associated with

a decrease in smoking initiation and past-month smoking, especially among youths and young adults. The impact varied across different subpopulations (male, female, white and black).

A systematic review about the impact of prices and taxes on the use of tobacco products in Latin America and the Caribbean (58) showed similar results with a negative and statistically significant effect of higher prices via tax increases on cigarette consumption.
These results suggest that excise taxes remain an efficient element of public health policies to improve population health and reduce tobacco associated morbidity and mortality.

Price elasticity of demand is an economic concept that measures changes in consumption resulting from a change in the product of a price (35). Excise taxes are used in order to reduce the health burden associated with smoking and to generate revenue (41,57,59). However, as an unintended consequence, they can lead to smuggling across boarders (38). In addition, assuming cross price elasticities of the demand for other tobacco products, the change in the price of one tobacco products such as combustible cigarettes can impact the use of another tobacco product, such as e-cigarettes (35).

Assuming cigarettes and ENDS to be substitutes, according to Taxfoundation (12), there might be some correlation between the current growth in the vapor market and the decline in the cigarette market. Whereas smoking rates have been declining especially among the youth, the vaping market has been growing in many US states.

In their study about prices and e-cigarette demand in the EU, Stoklosa et al. (60) found out that every 10 percent increase in e-cigarette prices is associated with a drop of e-cigarette sales of approximately 8.2 percent. These results indicate that the sales of ENDS are responsive to price changes, which suggests that excise taxes can help the government to reduce the consumption of e-cigarettes similar to combustible cigarette consumption. The authors further suggest that e-cigarette demand is more responsive to price than the demand of combustible cigarettes.
If regular combustible cigarettes and e-cigarettes are considered **substitutes**, higher prices of combustible cigarettes are likely associated with increased sales of e-cigarettes and linked to a likely smoking decline, which goes along with the theory of cross-price elasticity. Moving from combustible cigarettes to an electronic device might have positive health effects when switching completely. Nevertheless, this can also lead to dual use of both products, as users

often don't succeed in switching completely. Besides, taxes on e-cigarettes could deter vaping initiation by never users (especially young adults), while greater tax increases on regular cigarettes could incentivize switching from combustible to electronical products, as long as they are cheaper.

Pesko et al. (61) show similar results analyzing data from 2011 to 2017 for the effect of tax rate changes on cigarettes and e-cigarettes on the use of these products among US adults. However, they do not find clear evidence whether taxes for ENDS influence traditional cigarette use.

If cigarettes and ENDS are considered as substitutes, imposing high excise taxes on ENDS could risk pushing vapors back to smoking (3,12). This indicates that the tax amount needs to be considered carefully in order to have a positive effect on the public health by not pushing former smokers back to smoking due to too high prices, but also by not leading to a nicotine addiction by current users of ENDS and never-smokers. The impact of high vaping taxes on smoking prevalence will be discussed later, using the example of Minnesota which was the first US state that imposed an excise tax on ENDS in 2010 (3).

3.6.2. E-cigarettes as a Gateway to Nicotine Addiction

Some researchers assume that vaping might increase the likelihood of smoking initiation and function as a gateway to nicotine addiction (12,62). But as many people are using e-cigarettes to help them quit smoking, one could also assume a beneficial impact on smoking cessation (harm reduction).

In their systematic review, Khouja et al. (63) found out that there seems to be a strong association in observational studies between the use of e-cigarettes among non-smokers and later smoking initiation among young adults. However, clear evidence is missing in published studies that there is a causal relationship leading to a gateway effect rather than a shared common cause of both uses (nicotine addiction).

Assuming a gateway effect to nicotine addiction and later smoking, policy makers should consider among taxing e-cigarettes to restrict also the youth access, marketing, youth-appealing flavours and nicotine concentration of ENDS to decrease youth vaping rates. Chaloupka et al. (21) argue that relatively higher excise taxes on combustible tobacco products can help promote quitting and deter initiation among non-smokers and reduce dual use.

3.6.3. Harm Reduction Principle

The issue of "**harm reduction**" has been discussed controversially in the public health practice of tobacco control. E-cigarettes are considered to be a harm-reduction approach for smoking cessation by some as their use could deter current smokers from smoking and avoid other harmful ingredients of combustible tobacco products but still provide nicotine. Compared to conventional cigarettes, e-cigarettes seem to be less harmful and exposure to aerosolized carcinogens and toxins seems to be decreased. Still, there are harmful chemicals present in the vapor emitted by e-cigarettes. Public Health England reported in August 2015 that e-cigarettes were approximately 95 percent safer than traditional smoking and further indicated that e-cigarette use could reduce health disparities caused by smoking by providing a relatively save approach to quit smoking. (12,62,63)

Smokers switching completely or mainly to vaping could be considered beneficial from a public health standpoint by reducing smoking associated morbidity and mortality. (1,31) Therefore, some policy makers would consider ENDS to have a positive impact in reducing harm related to smoking. They argue to encourage the use of these products and not severely regulate them in order to convince as many smokers as possible to switch from smoking to vaping (64). Low-Risk products and approved nicotine replacement therapy would then not be taxed or taxed at a lower base than combustible products due to their reduced harm, because changes in the relative price of tobacco products can lead to substitution with less expensive products. (21)

3.6.4. E-cigarettes as a Smoking Cessation Aid

The use of ENDS as a smoking-cessation aid is controversial. (8,11) Despite their promotion as a **smoking cessation** product due to their proposed harm reduction approach, FDA has not approved ENDS as a smoking cessation product due to still unknown long-term impacts on health (38). In contrast, Switzerland earlier did not levy an excise tax on ENDS, suspecting they might help smokers to quit. In the near future, Switzerland will nevertheless tax ENDS due to unknown effectiveness as a smoking cessation aid, unknown long-term health effects and increasing vaping rates among the youth. Overall, there is still insufficient evidence on the effectiveness of ENDS as a cessation aid. (1)

In their RCT, Hajek et al. (65) compared e-cigarettes and NRT as a cessation aid. A total of 886 participants underwent randomization. In this U.K. study, e-cigarettes resulted to be more effective for smoking cessation aid than NRT for adult smokers (aged 33-53) seeking help to

quit smoking combined with a face-to-face behavioral support, with a one year abstinence rate of 18 percent in the e-cigarette group compared to 9.9 percent in the NRT group. The NRT group was informed about the range of different nicotine-replacement products and selected their product of preference and were free to switch and combine products. E-cigarette users used first generation, cartridge-based e-cigarettes and were encouraged to experiment with e-liquids of various strengths and flavours. However, the rate of abstainers continuing to use e-cigarettes was very high with 80 percent of the participants in the e-cigarette group still using e-cigarettes at one year, compared to only 9 percent still using nicotine-replacement products at one year. This can be seen as problematic, as long-term health effects of ENDS still need to be elaborated. In addition, the results may only be valid for smokers who seek help to quit smoking, and not generalizable to smokers who try e-cigarettes for other reasons than trying to quit smoking and may not be suitable for later generation e-cigarettes.

In their systematic review, Glasser et al. (66) found RCTs and population-based studies that suggested that ENDS were at least as effective as NRT for smoking cessation or to reduce smoking. Still, they also found studies with no change or negative correlations with smoking cessation. This also indicates, that in this field further longitudinal studies are needed.

If ENDS were promoted as a smoking cessation aid, policymakers should acknowledge their harm reduction potential in comparison to combustible cigarettes and on account of this should not levy an excise tax on them or a substantially lower amount compared to other, more harmful tobacco products. (21)

3.6.5. Dual Use of Combustible Cigarettes and E-cigarettes

Furthermore, using e-cigarettes as a cessation aid to quit smoking, can lead to a **dual use** and therefore to potential additional risk (65). In the opposite direction, the use of e-cigarettes by never smokers can lead to (additional) later smoking (63).

If dual use is a temporary transitional stage before combustible cigarette users completely transition to e-cigarette use alone, the greatest health benefits would be expected. In contrast, using both products can lead to additional risks. (31)

Another reason to use ENDS additionally is to evade smokefree policies or because they are perceived to be less harmful, which might be associated with an increased likelihood of trying e-cigarettes (1,67).

Overall, e-cigarettes are relatively new but became increasingly popular among the youth. Long-term health effects are unclear and lead to unknown consequences for the public health. Therefore, it is important to regulate the current use and exposure.

4. Methods

4.1. Excise Taxation Methods

In the US, tobacco excise taxes have been an effective tobacco control tool since 1864. Imposing an excise tax on ENDS is one possible and furthermore simple strategy to improve public health by limiting consumption and youth access.

Whereas an excise tax on ENDS is still missing in Switzerland, several US states have imposed different methods of excise taxation on e-cigarettes.

By decreasing supply and demand for a product through price increases, excise taxes are applied to discourage certain behaviors. Excise taxes are also imposed to price externalities associated with the consumption of a specific good. (12,68,69) An externality means in economic terms "the side effect or consequence of an activity that is not reflected in the cost of said activity" (12). This means that for instance a part of the health-care related costs due to frequent smoking or vaping are covered by these excise taxes.

Higher tobacco excise taxes are considered to lead to a decline in its use and influence the smoking, or in this case also the vaping behavior. Tax or price increases can lead to cessation of consumption, reduced consumption or a trade-down, which means moving from a higher priced brand to a lower priced brand. (12)

Concerning the rate of which ENDS are taxed, this is also relevant for the fact that ENDS could be considered less harmful substitutes for combustible cigarettes. Therefore, high rates might risk pushing vapers back to smoking, which will be discussed later in chapter 5 and 6. Taxation could not only reduce e-cigarette use and initiation among adults, but also generate revenue for the government and can be considered as a replacement source for the declining revenues of combustible tobacco products. The rapidly changing diversity and development of e-cigarette products (and also other tobacco products) and the different ways in which they are consumed are current challenges regarding taxation policies. (4)

There are generally three different ways excise taxes are currently levied on ENDS at US state level: pure ad valorem, pure specific or mixed systems for open and closed tanks. (12,45,68)

4.1.1. Ad Valorem

An excise tax **ad valorem** is a percentage of some measure of the value of a tobacco product. In this case, retail or wholesale prices are used as the base value. (12)

Most of the states levying ad valorem taxes in the wholesale or retail price have broadened existing tobacco tax categories to include vaping devices as a category "other tobacco products" (12).

If a brand improves the quality of a product such as for example the packaging, flavouring or other product designs which may increase the appeal to consumers (but quality not meaning less damaging to health) an increase of $1.00 for a product with an ad valorem tax of 25 percent leads to an increased price of $1.25, a part of which will go to the government as a revenue. This means that ad valorem taxation can lead to a price increase higher than the increased costs (multiplier effect), creating a gap in prices between brands and increasing the incentive for consumers to trade down from high- to low priced brands as a response to increased prices (12). Therefore, a taxation ad valorem could influence consumer choice negatively, especially for more price-sensitive customers (such as the poor or youth). (35,39)

Levying ad valorem taxes on electronic devices or cartridges is challenging because there exist many different vaping devices, some of which are disposable or reusable (open tanks that are refillable or closed tanks such as JUUL). If devices are reusable, they are bought less frequently. This means that a taxation on devices could have a smaller effect on those already using the product, as they would only have to buy the additional closed tank or refillable e-liquid for open tanks. (12)

Overall, the taxation ad valorem can lead to disparate treatment of vapor products, because some products are single-use while others are rechargeable and refillable. (4)

4.1.2. Specific Tax

Another way to tax vapor products is a **specific** excise tax as a fixed monetary amount based on quantity respectively on the volume or weight of tobacco or liquid (amount per milliliter). Compared to an ad valorem taxation, there is no multiplier effect in specific taxation, creating greater incentives for manufacturers to raise quality. An increase in a pure specific tax leads to a reduction in the ratio of prices of higher priced brands relative to lower priced brands, meaning that the tax as a percentage of the price is lower for high priced brands than for lower priced brands. This could reduce a consumers' incentive to substitute downward from higher to lower priced brands and could possibly result in a higher willingness to pay for more higher priced brands. (62)

The specific taxation of usable liquid product for ENDS is imposed in many US states (table 1, chapter 4.2). Typically, specific e-cigarette excise taxes have lower rates than taxes ad valorem. While most states tax the e-liquid per milliliter regardless if it contains nicotine or how

much it contains, there are some states that do **not** tax non-nicotine-containing liquid, meaning they explicitly only tax nicotine based liquid in their statutes, such as currently as of January 2020: Connecticut[7], Delaware[8], Louisiana[9], Minnesota [10], New Hampshire[11], New Jersey[12] and Ohio[13]. (45) This may be problematic by ignoring the fact that nicotine isn't the only toxic substance contained in the e-liquid. From a preventive point of view therefore, it makes more sense to tax the liquid on the whole, whether or not it contains nicotine, as most states do. In addition, a specific rate avoids discriminating between disposable and reusable products and therefore avoids discriminating between various product designs. Besides, they are not affected by consumers' product preferences or price volatility. (12)
The WHO further states that "simpler is better", meaning complex tax structures are more difficult to administer and create more opportunities for tax avoidance and evasion (39).

4.2. US E-cigarette State Regulation

In the US, states have the authority to impose taxes on ENDS (1,12). As vaping products are relatively new and vary in their appearance, many US states are questioning on if and how to tax these products. Whereas each US state charges conventional cigarettes with an excise tax in addition to the federal tax, as of January 2020, 21 states and the District of Columbia (Washington DC) were taxing vaping products (45). Two more states, Utah and Wyoming, followed in July 2020 with a taxation ad valorem and Kentucky in August 2020 with a mixed system. There are currently three designs to tax ENDS at a state level shown in table 1 according to Public Health Law Center's 50 State Review: pure ad valorem, pure specific and mixed taxation systems for open and closed tank systems. (4,45,70)
The range of taxation rates, the implementation date and the legal product definition of ENDS vary widely. Some states define ENDS by including them to tobacco products (as "other tobacco products") or separating them from this product category (for example as "alternative nicotine product", "vapor product" or "electronic nicotine device"). Some states consider "tobacco products" to *include* products *made or derived* from tobacco. Since most e-cigarettes contain nicotine derived from tobacco but not tobacco itself, they would be considered under

[7] Ct. House Bill No. 7424, Public Act No. 19-117
[8] Del. Code Ann. tit. 30 § 5301(20)
[9] La. Rev. Stat. Ann. § 47:841(F)
[10] Minn. Stat. Ann. § 297F.05(3)
[11] N.H. Rev. Stat. Ann. § 126-K:2(II-c); 175:1(XXXI-a)
[12] N.J. Stat. § 54:40B-2
[13] Ohio Rev. Code Ann. § 5743.01(U)

this category in these states (12). A further problem might be that not all e-cigarettes use tobacco-derived nicotine, as there exist devices using nicotine from other sources such as eggplants, potatoes or tomatoes. These products therefore would not be subject to the FDA's deeming rule because of not meeting the statutory definition. (1,6) Tobacco control laws therefore need to acknowledge rapidly evolving products.

Table 1 on the following page shows that only five states that were currently taxing ENDS did *not* define ENDS under the category "tobacco product" or "other tobacco products": Kansas, Louisiana, New York, Washington and Wisconsin (6,45,71). These states in contrast define ENDS as an own product class. The first state excise tax was levied in 2010 by Minnesota, then North Carolina and Louisiana followed in 2015, West Virginia in 2016 and many more states did so until today.

Minnesota was the first state to begin taxing e-cigarettes in 2010. They are currently taxed at the rate of 95 percent of the wholesale price. North Carolina in contrast took a different approach as the second state to tax vaping devices. In 2015, the state legislature taxed vapor products at a specific rate of $0.05 per milliliter of e-fluid. (12) States that just recently imposed a tax on ENDS often distinguish between closed cartridges (disposable) and open cartridge-based devices, such as Connecticut, New Hampshire, New Jersey, New Mexico and Washington.

The rate of *specific excise* tax per milliliter of liquid varies from $0.01 up to $0.30 for pure specific taxation systems. There also exist *ad valorem* taxes in different states, varying strongly from 15 to 95 percent of the wholesale or retail price. Furthermore, there are mixed excise taxes which differentiate between open and closed tank systems. Closed tanks are disposable and are taxed differently from open, reusable (refillable) cartridge systems as referred to in table 1. Usually, open tanks are taxed at lower rates than closed systems, which mostly contain more nicotine (such as JUUL with its pods). (12,71) Similarly, states vary widely in the amount of state excise cigarette taxes on a 20-pack of combustible cigarettes, from $0.45 in North Carolina with the lowest and $4.35 with North Carolina and New York as the highest amount, being added to the federal tax of $1.01.

For the state comparison in the following chapter, publicly available data on state's governmental internet pages and reports will be analyzed, their tobacco laws as well as current research on tobacco policies and surveys generating data on local smoking and vaping prevalence.

Table 1 US States with Laws Taxing E-Cigarettes[14] (45) (enacted as of June 15, 2020)

US state	State Excise Tax on E-Cigarettes	ENDS taxed since	ENDS defined as tobacco products	Cigarette state tax (37)
California	59% wholesale price	4/1/2017	yes	$2.87
Connecticut	• $ 0.40 per ml of closed cartridges (disposable) • Open cartridge 10% of wholesale price • Nicotine only	10/1/2019	yes	$4.35
Delaware	$ 0.05 per ml, nicotine only	1/1/2018	yes	$2.10
District of Columbia (DC)	91% of wholesale price	10/01/2019	yes	$4.35
Illinois	15% of wholesale price	7/1/2019	yes	$2.98
Kansas	$0.05 per ml	1/1/2017	no	$1.29
Louisiana	$0.05 per ml, nicotine only	8/1/2015	no	$1.08
Maine	43% of wholesale price	1/2/2020	yes	$2.00
Massachusetts	75% of wholesale price	6/1/2020	yes	$3.51
Minnesota	95% of wholesale price, nicotine only	8/1/2010	yes	$3.04
Nevada	30% of wholesale price	1/1/2020	yes	$1.80
New Hampshire	• $ 0.30 per ml of closed cartridges (disposable) • Open cartridge: 8% of wholesale price • Nicotine only	1/1/2020	yes	$1.78
New Jersey	• $ 0.10 per ml of closed cartridges (disposable) • Open cartridge 10% of retail price • Nicotine only	9/29/2018	yes	$2.70
New Mexico	• Open cartridges 12.5% of wholesale price • $0.50 per closed cartridge (disposable)	12/1/2019	yes	$1.66
New York	20% of retail price	12/1/2019	no	$4.35
North Carolina	$0.05 per ml	6/1/2015	yes	$0.45
Ohio	$0.01 per ml, nicotine only	10/1/2019	yes	$1.60
Pennsylvania	40% of wholesale price	7/13/2016	yes	$2.60
Utah	56% of wholesale price	7/1/2020	no	$1.70
Vermont	92% of wholesale price	7/1/2019	yes	$3.08
Washington	• $0.27 per ml of closed cartridges (disposable) • Open cartridge $0.09 per ml	10/1/2019	no	$3.02
West Virgina	$0.075 per ml	7/1/2016	yes	$1.20
Wisconsin	$0.05 per ml	10/1/2019	no	$2.52
Wyoming	• Imported by wholesalers: 15% of wholesale price • 7.5% of retail price upon the use or storage by consumers	7/1/2020	no	$0.60

[14] «As used in this table, e-cigarette broadly refers to any product, and its component parts and accessories, that contains nicotine and/or other substances intended for use in the form of an aerosol, often referred to as vapor» (45)

4.3. Analytical Framework: Health Policy Triangle

The aim of this paper was to analyze and compare the e-cigarette policies of two selected US states and to give an advice on how e-cigarettes could be taxed in Switzerland. The Swiss e-cigarette taxation is lacking behind US taxation. However, as both countries have a very similar, federal system, policies are comparable to each other.

The Health Policy Triangle (HPT) is a deductive, qualitative content analysis. Walt and Gilson (1994) developed this triangle framework especially for the analysis of health policies and focus on four fields that have a critical role and interact with each other while forming policies: Content, Context, Process at the three triangle corners and Actors in the center of the model. (72)

We will therefore focus for the health policy analysis on these fields according to Walt and Gilson, and will concentrate on the content (what is the policy about, outcomes of the policy), the context (why is this policy needed, the circumstances), on the process (how was the policy implemented, its formulation) and the involved actors, which won't be analyzed in depth.

The goal is to analyze current e-cigarettes policies of US states retrospectively and compare two states who have developed and implemented two entirely different ways of levying excise taxes on ENDS. Prospectively, the goal is to develop recommendations on how to effectively tax new tobacco products from a public health point of view. As e-cigarette tax regulation in Switzerland is lacking behind, US taxation patterns and their impact could be considered and function as a guidance for a future e-cigarette taxation policy in Switzerland.

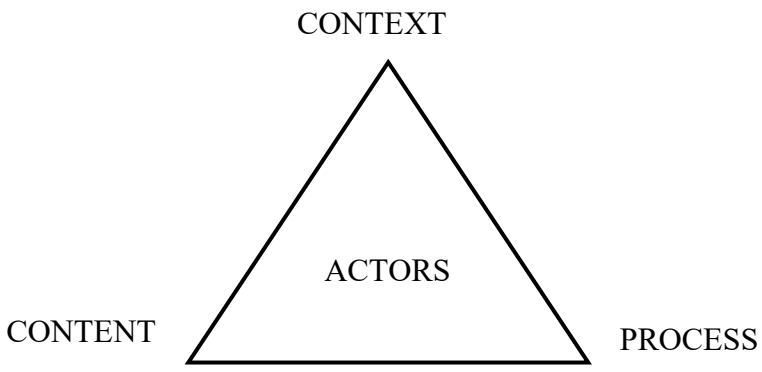

Figure 5 Health Policy Triangle
(adapted from Walt and Gilson, 1994)

The HPT targets on analyzing the following components (figure 5):

The *Content* aims to analyze what the health policy is about, the objectives and the outcomes. The *Context* includes political and administrative factors influencing the health policy, economic and financial factors and social and cultural factors. The *Process* focuses on Agenda-Setting, policy formulation, implementation and evaluation and the *Actors* shall examine involved stakeholders. (72)

5. Results

5.1. US State Comparison: Case Selection

As explained in table 1 in the previous chapter, two different US states were compared via Walt and Gilson's HPT. Therefore, two states with different e-cigarette excise taxation methods were chosen. As we also aimed on discussing the impact of a health policy on the people's smoking and vaping behavior via locally conducted surveys, the effect of earlier imposed taxes would be easier to examine, as there is more likely available data. Furthermore, a delay in the available data after the implementation of a policy has to be expected. Besides, changes in smoking habits take time and most states have just recently started to collect data on vaping behaviour.

Consequently, two states with different, earlier levied taxation methods and tobacco product definitions were compared.
The first state analyzed was Minnesota, as it was the first US state to levy an *ad valorem* excise tax of 35 percent in early 2010 and even strongly increased the tax in 2013 to 95 percent of the wholesale price. Minnesota is including ENDS in its definition of tobacco products.
As a comparison, Louisiana does not include ENDS in its definition of tobacco products, has imposed a significantly lower excise tax based on a specific rate of $0.05 per milliliter of only nicotine-containing liquid and imposed the tax in July 2015.

5.2. Minnesota

5.2.1. Process

Minnesota was the first US state to levy a tax on e-cigarettes with the Tobacco Modernization and Compliance Act (TMCA) of 2010 (House File 3467, Senate File 3055, Chapter 305 of Minnesota's statutes). It was introduced at the senate in March 2010, taking effect as of August 1st the same year. The state statutes' definition of "tobacco products" was modified with impacts on tobacco product's excise taxation. The earlier definition was suitable for fewer products only intended for smoking or chewing, whereas the new definition broadened the earlier definition of tobacco products to include "products that are designed to be consumed in ways *other* than through chewing or smoking". (3,73–75)

The Minnesota Statutes were changed in chapter 305, section **297F** regulating "Excise and Sales Taxes" as follows:

Sec. 2 Minnesota Statutes 2008, section §297F.01, Subd. 19 is amended to read (76):

Subd. 19. Tobacco products.[15]

"Tobacco products" means any products containing, made, or derived from tobacco that is intended for human consumption, whether chewed, smoked, absorbed, dissolved, inhaled, snorted, sniffed, or ingested by any other means, or any component, part, or accessory of a tobacco product, including, but not limited to, cigars; little cigars; cheroots; stogies; periques; granulated, plug cut, crimp cut, ready rubbed, and other smoking tobacco; snuff; snuff flour; cavendish; plug and twist tobacco; fine-cut and other chewing tobacco; shorts; refuse scraps, clippings, cuttings and sweepings of tobacco, and other kinds and forms of tobacco, ~~prepared in such manner as to be suitable for chewing or smoking in a pipe or otherwise, or both for chewing and smoking~~; but does not include cigarettes as defined in this section.

Tobacco products excludes any tobacco product that has been approved by the United States Food and Drug Administration for sale as a tobacco cessation product, as a tobacco dependence product, or for other medical purposes, and is being marketed and sold solely for such an approved purpose."

The new enacted legislation within the TMCA also made changes within youth access regulation and the requirement for retailers to obtain a tobacco retail license. The updated definition included new products that before were evading tobacco tax laws, taking into account the evolving tobacco industries' products. This shows the relevance of legal product definitions in a time of evolving product markets (6).

Whereas Minnesota Statues §297F.05 Subdivision 1 defines rates of tax for conventional cigarettes (per piece), subdivision 3 defines the tax rate of other tobacco products as follows (77):

RATES OF TAX; PERSONAL DEBT.

Subdivision 1. ***Rates; cigarettes.***

[15] KEY: ~~stricken~~ = removed, old language. underscored = added, new language.

A tax is imposed upon the sale of cigarettes in this state, upon having cigarettes in possession in this state with intent to sell, upon any person engaged in business as a distributor, and upon the use or storage by consumers, at the following rates:

(1) on cigarettes weighing not more than three pounds per thousand, 24 mills on each such cigarette; and

(2) on cigarettes weighing more than three pounds per thousand, 48 mills on each such cigarette.

[...]

Subd. 3. ***Rates; tobacco products****.*

"A tax is imposed upon all tobacco products in this state and upon any person engaged in business as a distributor, at the rate of 35 percent of the wholesale sales price of the tobacco products. The tax is imposed at the time the distributor:

(1) brings, or causes to be brought, into this state from outside the state tobacco products for sale;

(2) makes, manufactures, or fabricates tobacco products in this state for sale in this state; or

(3) ships or transports tobacco products to retailers in this state, to be sold by those retailers.

Due to the new tobacco product's definition, FDA approved smoking cessation products were excluded from the tobacco product excise tax, while e-cigarettes, which are inhaled, were included since August 1, 2010. Tobacco products other than cigarettes were taxed at 35 percent of the wholesale price, whereas cigarettes were taxed at a higher per-unit level per 20-pack of cigarettes. (77)

Prior to the later tax hike in 2013, Minnesota had a "tobacco health impact fee" of 35 percent of the wholesale price in its statutes in chapter 256, section 256.9658 with the following purpose[16]:

Subdivision 1. ***Purpose.***
"A tobacco use health impact fee is imposed on and collected from cigarette distributors and tobacco products distributors to recover for the state health costs related to or caused by tobacco use and to reduce tobacco use, particularly by youths."

[16] https://www.revisor.mn.gov/statutes/2011/cite/256.9658

The fee was repealed in July 2013 in House File 677[17], Senate File 552, and offset by a regular excise tax increase from 35 to 95 percent of the wholesale price of the product on the "other tobacco products" category (House File 91). The excise tax ad valorem applies not only on ENDS, but also on the other tobacco products defined in §297F.01, Subd. 19. The actual increase was from 70 to 95 percent because the health impact fee additional to the excise tax led to a doubled total fee/tax on the other tobacco product's wholesale price (defined as the price at which a distributor purchases a tobacco product (78)). At the same time, cigarette excise taxes per piece were increased from 14.5 cents prior to 28.3 cents, leading to a substantial increase from $1.23 to $2.83 per 20-pack in 2013 (with the repeal of the health impact fee) and to $3.04 as of January 1, 2017, with an additional in-lieu sales tax and the federal tax $1.01 of adding to this price. This leads to an average final price of around $8 for a pack of cigarettes. Minnesota is one of the states with the highest taxes on tobacco products. (37,79) The tax is collected at the cigarette distributor, who has to purchase payment stamps as a proof-of-tax to be affixed to product packaging (Minn. Stat. §297F.25). (80)

Currently, in Minnesota e-cigarette cartridges with their e-liquid containing nicotine and disposable e-cigarettes as a whole device are subject to the ad valorem tobacco tax of 95 percentage of the wholesale price, depending on the form they are sold (see Minnesota Statue 297F.01, subdivision 22b). Liquid and cartridges not containing nicotine and reusable/refillable devices are not subject to the excise tax. If the device is sold separately from the cartridge, it is not taxed either (62,81).

The Louisiana Department of Health investigated the impact of e-cigarette taxation in a report from 2018 (9) facing challenges in Minnesota's tobacco tax statute, mentioning the disparate treatment between different designed vapor products. Besides, the current law results in artificially lower taxes on vapor products when the liquid is mixed in Minnesota (as its mostly the case for vapor shops) and high taxes for similar products, when shipped into Minnesota in their final consumable form. A bill proposed in 2017 tried to change this discrepancy, but did not move forward.

In addition, the current definition in Minnesota Statute 297F.01 subdivision 22b taxes not only solutions containing nicotine made or derived from tobacco, but also "sources other than

[17] In the same Omnibus Tax Bill, HF677, "little cigars" were excluded in the other tobacco product definition of section 297F.01, subdivision 19 and taxed at the same level as cigarettes.

tobacco" as of January 1, 2020. This wording takes into account developing product innovations, possibly gaining nicotine from other sources. (81)

5.2.2. Content

One reason for the TMCA in 2010 was to cover a broad range of new evolving tobacco products, which before evaded tobacco product taxation, such as "little cigars", e-cigarettes and dissolvable, Tic-Tac like strips or orbs. As these Tic-Tac like products such as Camel Orbs were candy-like and allowed a nicotine bump anywhere and undetected, Minnesota policy makers wanted to protect the youth from nicotine addiction by addressing to "a new generation of tobacco users" (82). Therefore, a major aim of the TMCA also called Tic-Tac act was to close this loophole in tobacco taxation to cover products which target especially younger generations. The new definition aimed to cover a broad range of new products derived from tobacco, which were consumed in other ways than conventional "smoking" and were therefore not covered yet in the state's tobacco tax and youth access laws.

Among broadening the definition of tobacco products, the bill also required tobacco related devices to be sold behind the counter and prohibited their sale to minors. (75)

The new definition included a range of new tobacco products to be taxed. Prior to the tax hike in July 2013, cigarette and tobacco state tax revenues were deposited into the three following state funds: General Fund, Health Impact Fund and Special Revenue Fund. After July 1, 2013, the proceeds were deposited into two state funds and a stadium reserve account. (78) In the fiscal year 2019, Minnesota reported revenues from cigarette and tobacco taxes of $624 million. Each fiscal year, $22.25 million is dedicated to the Academic Health Center at the University of Minnesota and $3.94 million to the medical education and research account (§297F.10 Deposit of Proceeds).[18] Vapor products generated 4 million dollars of revenue in the fiscal year 2014; 4.5 million in 2015, 5.7 million in 2016 and 7 million in 2017 (9).

Recent research (3) found out that the high tax for ENDS has "increased adult smoking and reduced smoking cessation in Minnesota". The National Bureau of Economic Research (Saffer et al.) suggested that in the sample period of ten years about 32'4000 adult smokers would have quit smoking in Minnesota in the absence of the tax. The authors suggest that increased prices lead to reduced consumption of e-cigarettes, implying that ENDS are a likely substitute

[18] https://www.house.leg.state.mn.us/hrd/pubs/ss/sscigtax.pdf

for combustible cigarettes among smokers, estimating cross-price elasticity. In their calculations in a synthetic control design they are comparing Minnesota's smoking prevalence to the rest of the US. They further state that if e-cigarettes were taxed at the same rate as combustible cigarettes, this would lead to higher smoking rates and decreased quit rates.
These findings illustrate that among other deterrents for adolescent cigarette use such as raising the legal purchase age and implementing smokefree laws, the relative amount of a tax must be considered carefully, acknowledging the harm reduction potential of ENDS for current smokers but also the danger of leading to nicotine-addiction for never-smokers.

Recent data investigates current tobacco use in Minnesota among Minnesota's youth (Minnesota Youth Tobacco Survey, MYTS 2017) and adults (Minnesota Adults Tobacco Survey, MATS 2018) and have been collecting data regularly since 1999 (83).
MYTS data are collected in schools and are pencil-and-paper-based. The survey wants to get public health and tobacco-related data about Minnesota's youth from middle and high school students from 6^{th} to 12^{th} grade, with a number of 4112 students from 70 schools having participated in 2017. (83) The Minnesota Department of Health (84) states that among Minnesota students, e-cigarettes are used five times more often than conventional cigarettes. Over one of five Minnesota high school students who has tried e-cigarettes has never tried conventional tobacco products before. The use of any tobacco product in the past 30 days has been declining since start of the measurements in 2000 from 38.7 among high school and 12.6 percent among middle school students to 26.4 and 5.2 percent in 2017. Though, the use of any tobacco product among high school students has increased for the first time since measurement from 2014 to 2017 from 24.6 to 26.4 percent. While smoking among the youth has been decreasing, the use of e-cigarettes has been increasing. But as the first e-cigarettes have been available in the US since 2007, e-cigarette, hookah and snus specific questions have only recently been added to the MYTS since 2014 and have therefore only been analyzed in the survey of 2014 and 2017.
While in the MYTS from 2000 to 2017, the use of many tobacco products (excluded cigarettes) such as cigars and pipes continued to decline or stayed on a more or less constant level, the data showed an increase in e-cigarette use among the youth with the available data from 2014 to 2017. Over 19 percent of the high school students had used e-cigarettes in the past 30 days in 2017, an increase of 49 percent compared to the previous measure in 2014.
21.5 percent of the users reported using e-cigarettes exclusively. In contrast, only 9.6 percent reported having smoked cigarettes in the past 30 days, measuring the lowest youth cigarette

smoking rates for the first time in MYTS history. The research showed also that the likelihood of trying or regularly using tobacco products increases with age.

The MYTS data showed that half of current youth tobacco users used more than one form of tobacco in the past 30 days, with 51.3 percent of the Minnesota high school students and 43.5 percent of middle school students reporting polytobacco use. In addition, in 2017 overall more than 60 percent of the current tobacco users reported to have used a flavoured- or menthol-version. Students who used a flavoured version of a tobacco product most often used flavoured e-cigarettes, followed by smokeless tobacco. Students mostly indicated getting their e-cigarettes from friends or having someone purchasing them. (83)

MATS 2018 (85) is a telephone survey about the tobacco-related data of Minnesota's adult population (n=6050). Smoking prevalence decreased from 2000 to 2018 both on a national as well as on a state level from 23.3 percent in the US and 22.1 percent in Minnesota in 1999, to 13.8 percent both on national and state level in 2018. The smoking rates in Minnesota declined from 16.1 percent in 2010 to 14.4 percent in 2014 and 13.8 percent in 2018. The decline from 2014 to 2018 was not statistically significant though and the smallest decrease observed since MATS began. An adult smoker in Minnesota is more likely to be male and to have completed fewer years of education than nonsmokers. 15 percent of Minnesota men and 12.6 percent of women were current smokers in 2019.

Smoking prevalence declined the most in 18-24 year olds from 15.3 in 2014 to 8.5 percent in 2018, whereas e-cigarette use nearly doubled during the same period among this group from 12.8 percent in 2014 to 21.9 percent in 2018.

In contrast, **overall** the use of tobacco products other than cigarettes, including e-cigarettes, cigars, pipes, smokeless tobacco and waterpipe remained mainly the same from 2014 to 2018, with ENDS being the second often used products (5.9 percent in 2014 and 6.0 percent in 2018) after combustible cigarettes among adult users. (86)

Ever-use of ENDS was reported by 20.7 percent of Minnesota adults in 2018, with a constant decline among age groups, ranging from 44.4 percent of ever-users for 18-24 year olds to around 4 percent for adults aged 65 or older.

Overall, in 2018 44 percent of the past 30-day adult e-cigarette users were never-smokers, 37 percent reported to be current smokers and 19.1 percent were former smokers. This means that in 2018, the majority of ENDS users were people with no prior smoking history; whereas in 2014, only 11.7 percent reported to never having smoked before vaping, with 65.8 percent of the vapors being current smokers and 22.5 percent former smokers.

In 2018, among the young adults 72.6 percent reported never having smoked before using ENDS, compared to 30.4 percent in 2014. (86)
The most common reasons for adults using ENDS mentioned were: for curiosity (70.4 percent), because of the perception of being less harmful (47.7 percent), to cut down on other tobacco products (44.9 percent), to quit other tobacco products (42.3 percent), for enjoyment (41.8 percent), to evade smokefree laws (17.7 percent), because of the affordability (22.9 percent) and because they come in flavours other than menthol (8.4 percent). In contrast, a majority of young adults aged 18-24 (55 percent) and also minors (MYTS), used e-cigarettes because of their appealing flavours.
Among the approximately 574'000 adult smokers, around 45.7 percent reported having made a quit attempt in the past twelve months in 2018, whereas in 2014, 53.4 percent indicated to do so. Among those who made quit attempts in 2018, many used assistance such as medications (45.5 percent), counseling (15.4 percent) and ENDS (37.9 percent), although ENDS are not an evidence-based smoking cessation method. The rate was higher in 2014, though was not statistically significant. 11.6 percent reported to have been successful in quitting smoking, compared to a significantly higher rate in 2014.

In summary, MATS and MYTS data show that Minnesota smoking prevalence has been declining, especially young adults, whereas e-cigarette use has increased especially among young adults and high/middle school students. MATS data showed as well, that overall the majority of people using ENDS switched from smokers to non-smokers, especially among young adults. Among adults, conventional cigarettes remain the most commonly used tobacco product, whereas for young adults and students, ENDS are used more often.

5.2.3. Context

As mentioned in a previous chapter, the FDA has regulated conventional cigarettes since 2009 and finalized a rule in 2016 to extend their authority to cover other tobacco products such as ENDS. On a federal level, ENDS have not been regulated for a while.
Hence, Minnesota has played a major role in tobacco prevention with a leading function. It was the very first state to impose a tax on e-cigarettes in 2010, even before vaping products were popular. With the TMCA in 2010, Minnesota forbid the sale of nicotine products to minors. The FDA did the same on a federal level six years later with the deeming rule.
Prior, Minnesota was the first state to enact clean indoor legislation in 1975 with the Clean Indoor Act, creating "Smoking Permitted" and "Non Smoking" areas. Enacting smokefree

laws eliminates exposure to secondhand smoke and reduces smoking in youth and adults. In 2007, the Freedom to Breathe Act modified the Clean Indoor Act by prohibiting smoking in almost all public places, workplaces, public transportation and meetings. In 2014, the Clean Indoor Air Act was amended to also regulate ENDS in a number of specific locations. (87)
In addition, Minnesota was the first state to sue America's largest cigarette manufacturers for "deceptive and fraudulent marketing, targeting children and conspiracy to conceal the health effects of smoking" (80). The Minnesota landmark settlement lead to several restrictions on tobacco marketing to target children and misrepresentations about the health consequences of tobacco use. The tobacco companies were obliged to payments of several billions to the state of Minnesota, who invested for a non-profit health foundation (ClearWay Minnesota) and long-term health improvement for the state. (87) Until today, Minnesota gets annual payments of tobacco companies due to the settlement. In 1998, many US states followed and settled lawsuits against the five largest tobacco companies (known as the Master Settlement Agreement). As a consequence, the companies were obliged to pay these states approximately ten billions annually and providing restrictions on the sale and marketing of cigarettes.
Whereas the TMCA not only covered tobacco product definitions but also sale restrictions to minors, the FDA recently increased the federal minimum age to 21. Furthermore, the FDA restricted available flavours not only on cigarettes (in 2009), but recently also on ENDS. (80,88,89)

In their simulation model, Maciosek et al. (88) analyzed adult smoking prevalence in Minnesota from 1997 to 2016, falling from 21.8 percent in 1997 to 15.2 percent in 2016. The decline was attributed to significant policy changes restricting tobacco sales and use during this period. ClearWay Minnesota implemented tobacco control programmes restricting tobacco sales and use.
The state tax on a pack of cigarettes was increased from $0.48 in 1997 to $3.34 in 2014. The simulation model estimates by having reduced cigarette smoking within its period of almost ten years to have prevented 4118 smoking-attributable deaths in the state Minnesota, among economic healthcost related benefits.

In their Minnesota SimSmoke Tobacco Policy Model, Levy et al. (89) wanted to estimate the effect of tobacco control policies in Minnesota on smoking prevalence and attributed deaths. SimSmoke is a simulation model to discover tobacco control policy effects on smoking be-

havior. The authors applied Minnesota data between 1993 and 2011 in their SimSmoke simulation model to examine the effect of tobacco control policies such as tax increases, mass media campaigns, smokefree air laws, youth-access enforcement and cessation treatment policies on smoking initiation and cessation. In their model, tax increases had the highest impact in reducing smoking prevalence, especially among younger aged consumers, meaning that the effect is stronger in price sensitive consumer groups.

Due to ENDS being relatively new and almost unknown back in 2010 and sales still being relatively low in 2013, the timing of this tax hike might have been important for the use, because a high tax might have a weaker impact on the consumption of a mature product than on a relatively new one. (3,79,90) Saffer et al. (3) argument that newer products need more advertisement and more moderate prices in order to attract potential consumers. The timing of the tax levy and the hike three years later might therefore have been relevant for both smoking and vaping prevalence. Unfortunately, there is no data available on ENDS consumption prior to 2010, as there were very few vapors back then. Also, Minnesota Tobacco Surveys MYTS and MATS did not cover e-cigarettes until 2014. Still, the data showed that in a very short period of time, the rate of vapers especially among young students and adults has increased. A reason might be, that ENDS are still cheaper than combustible cigarettes and therefor more affordable especially for young people.

Amato et al. (79) investigated the effect of the tax hike in 2013 on e-cigarette consumption in Minnesota and compared sales data from Minneapolis and St. Louis (Missouri). Whereas there was a tax hike from 70 to 95 percent of the wholesale price for “other tobacco products” in Minnesota in 2013, the other cities did not undergo any changes to tobacco control policies. Too few ENDS were sold prior to the TMCA in 2010 to detect an effect of the imposed tax. The hike in 2013 led to almost doubled taxes for cigarettes and was followed “by a 12 percent decline in number of packs purchased at convenience stores over the next 6 months relative to the same months in the previous year” (79). The authors argue that an increase of both cigarette and e-cigarette taxes at the same time have the greatest public health benefit by discouraging dual-use and youth initiation. Mandating relatively higher prices for cigarettes in addition, smokers should be encouraged to quit and potentially switch to e-cigarettes. At the same time, the simultaneity of the tax hike makes it more difficult to investigate the effect of the e-cigarette tax hike on its consumption. Whereas higher prices for e-cigarettes are expected to reduce demand and sales, it is possible, that the higher price for combustible cigarettes may

have increased the sale of ENDS at the same time. In their evaluation, the authors detect a short-term spike in ENDS consumption at convenience stores immediately after the tax increase took effect. The authors assume that the spike might have been associated to smokers trying to quit. Their findings though are limited to the analysis of two brands (BLU, NJOY) with very different sales; whereas BLU sales increased, NJOY sales decreased. Data that explains the preference is missing. In addition, data was available only for closed systems bought at convenience stores and therefore not suitable for open system devices that are available in vape shops or the Internet.

5.2.4. Actors

Involved actors in forming and developing e-cigarette tax policy in Minnesota were Governor Tim Pawlenty signing the tax into law, as well as members of the House and Senate, being responsible for the legislation process in Minnesota. (82)
Additionally, the NPO ClearWay Minnesota, funded in 1998, has played a major role in tobacco control policy and funding research related to tobacco's harm and implemented programs for smoking cessation (the helpline QUITPLAN and nicotine replacement therapy), media campaigns and research such as Minnesota Tobacco Adult and Youth Survey (MATS; MYTS) which are surveys from ClearWay Minnesota in collaboration with the Minnesota Department of Health. (86,89)

There are, of course, more actors involved in local policy-making. Clearly, health organizations and tobacco companies affect the dynamics of policy adoption with different goals. However, the actors mentioned within the thesis are incomplete. Only a few involved persons or organizations with an important role in our findings are mentioned.
To gain further detailed information about the reasons why Minnesota implemented the tax in 2010 and why they chose a taxation ad valorem which was increased in 2013, two members with a major role in the TMCA of Minnesota's House (Rep. Jim Davnie) and Senate (Sen. Scott Dibble) were contacted via mail as well as the director of Public Affairs Molly Moilanen at ClearWay Minnesota at the beginning of August 2020. Until today, unfortunately no answer was received.

5.2.5. Summary

In the following, the results for **Minnesota** will be shortly summarized within the HPT framework.

As the very first US state, Minnesota began to tax ENDS with the TMCA in 2010; the goal of this also called Tic-Tac act was to apply an excise tax on different tobacco products by broadening the definition, adding a category of "other tobacco products" that priorly evaded taxation. At the same time a goal was to ban tobacco sales to minors and improving public health by targeting on products that were appealing to young consumers. The tax was increased again in 2013 and led to an ad valorem tax of 95 percent on "other tobacco products" and a substantial increase on combustible cigarettes per-pack at the same time. The taxation ad valorem turned out to be challenging for e-cigarettes as a broad class of products, leading to disparate treatments for different shaped e-cigarette products.

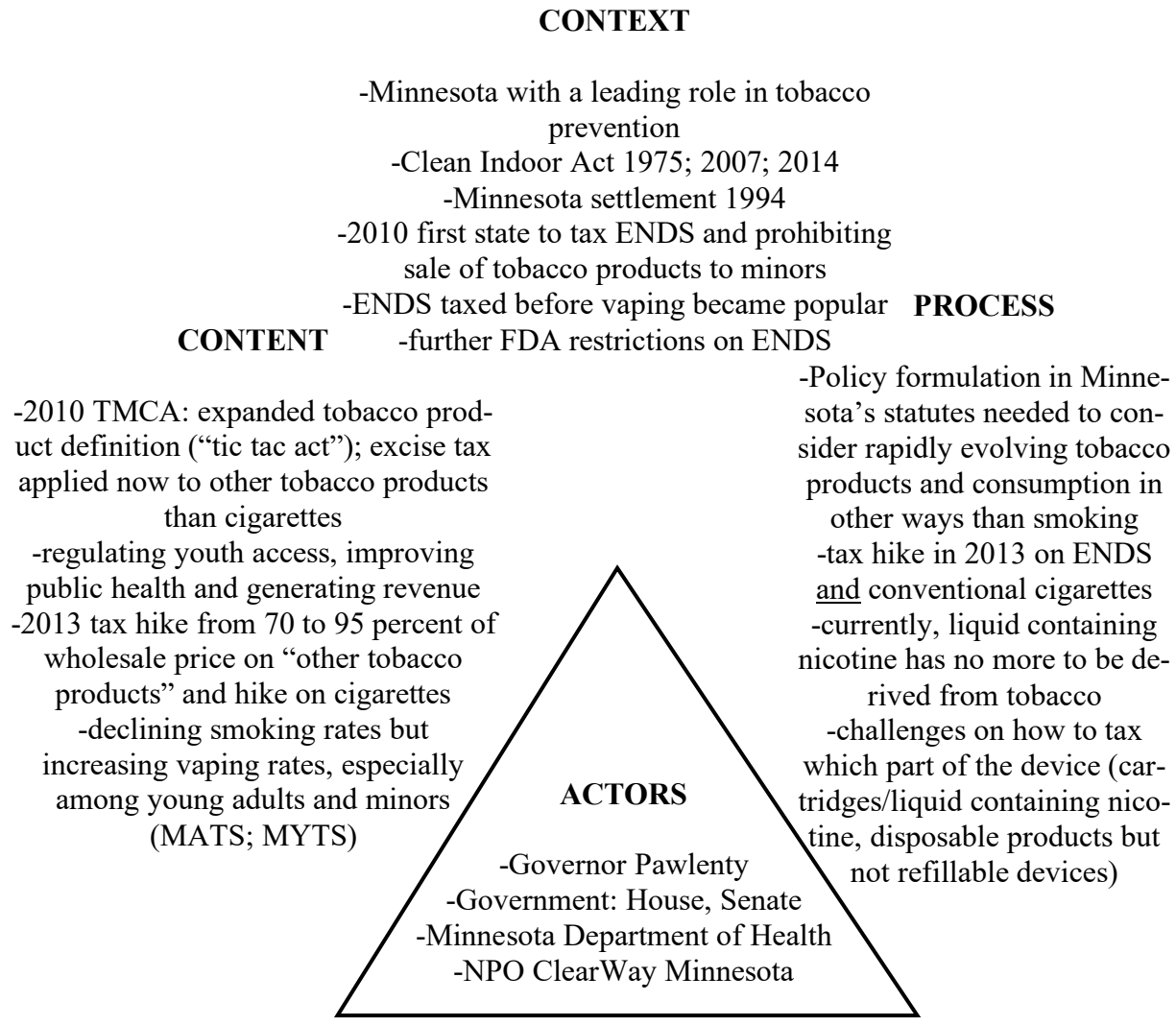

Figure 6 Minnesota Analysis in the HPT

5.3. Louisiana

5.3.1. Process

Louisiana has levied a state excise tax on e-cigarettes as one of the earliest in the US. According to the Louisiana Revenue Information Bulletin No. 15-023 (91), a few changes to tobacco taxation were enacted in Louisiana per Act 94. (92) This act raised the tax on a 20-pack of cigarettes from 36 cents to 86 cents by increasing the tax per cigarette in Revised Statute 47:841(B)(6), being effective as of July 1, 2015. Additionally, the act levied a specific excise tax on vapor products in 47:841(F); effective as of August 1, 2015, at five cents per milliliter of "consumable nicotine liquid solution or other material containing nicotine that is depleted as a vapor product" (91).

The tobacco tax is regulated in Louisiana Revised Statute §47:841 as follows (93):

§841. Imposition of tax

There is hereby levied a tax upon the sale, use, consumption, handling, or distribution of all cigars, cigarettes, ~~and~~ smoking and smokeless tobacco, and vapor products and electronic cigarettes as defined herein, within the state of Louisiana, according to the classification and rates hereinafter set forth:

[...]

B. Cigarettes.

(1) Upon cigarettes, a tax of sixteen twentieths of one cent per cigarette as defined in this Chapter.

(2) In addition to the tax levied in Paragraph (1) of this Subsection there is hereby levied an additional tax of four twentieths of one cent per cigarette.

(3) In addition to the tax levied in Paragraphs (1) and (2) of this Subsection, there is hereby levied an additional tax of four-twentieths of one cent per cigarette.

(4) In addition to the tax levied in Paragraphs (1), (2), and (3) of this Subsection, there is hereby levied an additional tax of seven-twentieths of one cent per cigarette.

(5) In addition to the tax levied in Paragraphs (1), (2), (3), and (4) of this Subsection, there is hereby levied an additional tax of five-twentieths of one cent per cigarette.

(6) In addition to the tax levied in Paragraphs (1), (2), (4), and (5) of this Subsection and in Paragraph (3) of this Subsection as continued in effect by Article VII, Section 4.1 of the Constitution of Louisiana, there is

hereby levied an additional tax of two and ten-twentieths of one cent per cigarette.[19]

(7) In addition to the tax levied in Paragraphs (1), (2), (4), (5), and (6) of this Subsection and in Paragraph (3) of this Subsection as continued in effect by Article VII, Section 4.1 of the Constitution of Louisiana, there is hereby levied an additional tax of one and two-twentieths of one cent per cigarette.[20]

[...]

F. Vapor products and electronic cigarettes. Upon vapor products and electronic cigarettes, a tax of five cents per milliliter of consumable nicotine liquid solution or other material containing nicotine that is depleted as a vapor product is used.

One year later, in Act. 4, House Bill 14 during the Extraordinary Session 2016, there was another tax hike leading to a total tax amount of $1.08 per pack of cigarettes, being effective as of April 1, 2016, adding R.S. 47:841(B)(7) to the tax on cigarettes, whereas the specific tax for vapor products remained at the same level (94). Table 1 in the previous chapter 4.2 shows that among those states taxing cigarettes and ENDS, Louisiana, North Carolina and Wyoming are the states with the lowest cigarette excise tax per 20-pack. Since 1970, Louisiana has increased the cigarette tax seven times, with the biggest hikes in 2015 and 2016.
These increased rates generate more revenue despite declining smoking rates. (95)
E-cigarettes and combustible cigarettes are subject to the taxes in R.S. 47:841 and are further defined in Louisiana's statutes as follows (LA R.S. §47:842 Revenue and Taxation) (96):

§842. Definitions

[...]

(2) "Cigarette" includes any roll for smoking made wholly or in part of tobacco, irrespective of size or shape and irrespective of the tobacco being flavored, adulterated or mixed with any other ingredient, where such roll has a wrapper or cover made of paper, or any other material except where such wrapper is wholly or in greater part made of tobacco.

[...]

(20) "Vapor products" shall mean any noncombustible product containing nicotine or other substances that employ a heating element, power source, electronic circuit, or other electronic, chemical or mechanical means, regardless of shape or size, used to produce vapor from nicotine in a solution or other form. "Vapor products" include any electronic cigarette, electronic cigar, electronic cigarillo, electronic pipe, or similar product or device and

[19] Cigarette tax hike (6) added in HB119, 2015 Regular Legislative Session
[20] Cigarette tax hike (7) added in HB14, 2016 First Extraordinary Session

any vapor cartridge or other container of nicotine in a solution or other form that is intended to be used with or in an electronic cigarette, electronic cigar, electronic cigarillo, electronic pipe, or similar product or device.

Overall, analyzing tobacco products definition in Louisiana's statutes makes it obvious that products are defined differently compared to Minnesota's statutes. Whereas Minnesota currently defines tobacco products in several different forms of consumption, whether "chewed, smoked, absorbed, dissolved, inhaled, snorted, sniffed, or ingested" (§297F.01 Subd. 19), Louisiana lists within R.S. 47:841 the products on which an excise tax is levied on, defined in R.S. 47:842 such as cigarettes in §842 (2); cigars §842 (3), smokeless tobacco §842 (15), smoking tobacco §842 (16) and vapor products §842 (20). (97) This means that Louisiana updated §841 to include vapor products and amended the taxed product's definitions by adding a new product category in R.S. 47:842(20). Other tobacco products listed in R.S. 47:841 such as cigars §841(A), smoking tobacco §841(C) and smokeless tobacco §841(D) are each taxed individually per percentage of the invoice price, differently from cigarettes and vapor products. The tax is due to from "from the dealer who first sells, consumes, handles or distributes vapor products in Louisiana" and has to be submitted monthly. (91,98)

5.3.2. Content

Louisiana began to levy a tax on e-cigarettes as of August, 2015 per Act 94 (House Bill 119). Different bills with the goal to raise tobacco taxes were introduced in 2015 Legislative Session with different intended hikes per 20-pack of cigarettes, some of them also aimed on taxing ENDS. The original Version of HB 119 did originally intend a higher tax on cigarettes of $1.18 and no tax on ENDS, but was later adjusted leading to a total of $0.86 per pack of cigarettes and to a new specific tax on ENDS of $0.05 per milliliter of e-liquid containing nicotine. With the passage of Act 94, the Tobacco Regulation Enforcement Fund was created to provide support to the Office of Alcohol and Tobacco Control for the purpose of tobacco regulation enforcement. This special fund is partly sourced of the revenue from Louisiana's tax on cigarettes. The funds from e-cigarettes are placed into the General Fund, whereas the funds collected from cigarette taxation are statutorily dedicated. From August 2015 to September 2017, a total of $1'834'098 had been collected from the inception of the tax on ENDS. (9)
R.S. §74:841.2 created a special fund called Tobacco Tax Medicaid Match Fund. (92,97)
R.S. §74:841.1 additionally gives further information on the amount of tax revenues going to the "Tobacco Tax Health Care Fund" as a special fund; a part of which goes to Louisiana Cancer Research Center and smoking prevention and tobacco control programs.

Nicotine addiction is a major concern in the use of ENDS, especially among young adults. Nicotine can harm the developing brain and can rapidly lead to an addiction and to the use of other nicotine containing tobacco products than e-cigarettes. This might be a reason why Louisiana only levies an excise tax on e-liquid containing nicotine. Nevertheless, nicotine isn't the only dangerous substance contained in the e-cigarette liquid, as there can be other carcinogens and toxic heavy metals found in the aerosol. However, the development of new products and the various design in which they appear, make the standard measurement conditions very challenging. (9)

The height of the excise tax on a specific level is furthermore much less than a tax ad valorem, as refillable systems mostly come in the size of 10 or 30 milliliter bottles, whereas JUUL pods contain a total of 2.8 milliliter of e-liquid when sold in a pack of 4. (4,12)

Trends in Louisiana youth tobacco use are analyzed in Louisiana Youth Tobacco Survey (LYTS). Data on e-cigarette use (=one or more days in the past 30 days) have been included since 2011, and ever-use since 2013. (99)

Despite the tax on ENDS, according to Well-Ahead Louisiana and Louisiana Campaign for Tobacco-Free Living, the **LYTS** indicated that e-cigarette use in Louisiana increased from 2015 to 2019 from 9.1 to 31.6 percent among high school students. Earlier, in 2011 and 2013 the number of current users was substantially lower with 2 percent of high school students and 0.4 percent of middle school students back in 2011, increasing to 1.4 of middle and 3.6 percent of high school students in 2013.

Among middle school students, the use increased from 4.8 to 8.6 percent from 2015 to 2017 and almost doubled from 2017 to 2019 to 15.4 percent. The ever use of an e-cigarette by high school students was 51.5 percent.

The main reason for initiation cited by middle and high school students was curiosity, whereas only a little more than one percent mentioned ENDS being cheaper than cigarettes as a reason for initiation. More than half of the high school students who had ever used e-cigarettes had used JUUL. Almost 50 percent of the high school students who had ever used e-cigarettes reported having obtained them from a friend. The most often cited reason for the consumption of ENDS was because of "friend or family member use" (36.8 of high school and 45.2 percent of middle school students) and one in five high school students reported to use them because they are available in different flavours (20.7 percent of high school and 14.2 of middle school students). (100)

Information about adult tobacco in Louisiana use is collected annually in the Behavioral Risk Factor Surveillance System (**BRFSS**), with questions about e-cigarettes introduced first in 2016, most recent data is available from 2017. Therefore, trend analysis is very limited up to this point.

Surprisingly, the percent of Louisiana adults who have ever-used or are currently using e-cigarettes according to BRFSS declined from 2016 to 2017 from 6 to 4.5 percent of current-users and 24.5 to 22.8 percent of ever-users. Current and ever-use was highest among male, white respondents and higher among young adults from 18-24 years old for 39.8 percent of ever- and 9.4 percent of current users, decreasing by age groups. In 2017, 20.7 percent of adults reported to smoke cigarettes, 2.3 percent to use e-cigarettes and 2.3 percent to use both (dual use). (99)

According to Glantz. et al (101), Louisiana has significantly higher tobacco smoking rates than the rest of the US. The BRFSS measured 20.5 percent of adult Louisianans were current smokers in 2018, whereas the US average was 16.1 percent. Besides, Louisiana's smoking rates have been above US average since 1994. Also, high school cigarette use was higher with the last available data from 2017 of 12.3 percent current users compared to 8.8 percent national average in that year. However, the smoking rates tend to decline over time.

5.3.3. Context

By the time Louisiana began to impose a tax on vapor products as of August 1, 2015 per Act 94 enacted during 2015 Regular Legislative Session, other states that were taxing ENDS were Minnesota, starting in 2010 with a higher tax ad valorem and North Carolina starting in 2015 with the same specific tax of 0.05 per milliliter. Whereas North Carolina has been taxing liquid regardless if it contains nicotine or not, in Louisiana only liquid containing nicotine is taxed. (9,45)

After the tax has been enacted, the Louisiana Department of Health submitted a report in 2018 and 2019 answering some questions addressing the use of ENDS requested in House Resolution 155 of the 2017 Legislative Session and House Resolution 109 of the 2018 Legislative Session. The Louisiana Department of Health studied the following issues associated with e-cigarettes: the health impact, whether ENDS are safe and effective as a cessation aid and the tax rates within the US. (9,99) The HR155 stated that according to the FDA, the percentage of US high school students using ENDS rose from 1.5 percent to 13.4 percent from 2011 to 2014

and therefore demanded further investigation about these products. (102) The trend in increasing consumption on vapor products might have been one reason to start taxing them. However, clear evidence for the reason tax on e-cigarettes was levied could not be found. According to Tax Foundation (9,62) and Glantz et al. (101), Louisiana imposed the tax mainly to help close budget shortfalls.

House Bill 119 was prefiled by Representative Ritchie in Legislative Session 2015 and should generate $250 million annually by increasing the excise tax on combustible cigarettes from $0.36 to $0.86, in addition to levy a smaller specific tax on "vapor products". (97,100) Compared to Minnesota and other US states, Louisiana has much lower prices for conventional cigarettes with an average price of $5.44 per pack. This includes a state tax of $1.08 similar to the federal tax of $1.01 per pack (table 1). With its state tax, Louisiana is below US average (101).

To generate public awareness and support for the bill, the "Invest in a Healthy Louisiana Coalition" organized events, in which Representative Ritchie promoted the tax to function as a way to deter the youth from smoking and save healthcare costs and lives. The final tax rate was lowered from prior $1.54 to $0.86 per pack of cigarettes, but increased again one year later in House Bill 14 in 2016, First Extraordinary Session to $1.08 for the same reasons: to help budget shortfalls, save lives, reduce healthcare costs and prevent youth use. The increase in HB14 was passed by a the Governor John Bel Edwards who faced a $943 million budget deficit, as Governor Jindal who passed Act 94 left office. The Invest in a Healthy Louisiana Coalition though had aimed for a higher tax increase with a bigger impact in protecting the public health. (101)

Levy et al. (103) applied their SimSmoke model on Louisiana to analyze tobacco control policies in this state. The model begins in 1993, with estimates projected through 2054. Actual prices are used from 1993 through 2013, and then calculates price changes based on price elasticities. The authors used available data on smoking prevalence and attributable deaths, smoke-free air laws, mass media policies and cessation services. Similar to the results found for Minnesota, the SimSmoke model predicted a higher excise tax to have the biggest impact in reducing smoking prevalence in Louisiana.

Louisiana's Tobacco Control Program (LTCP) was formed in 1993 under its Department of Health and Hospitals using funding from the CDC. Later, the LTCP began providing money

from the Master Settlement Agreement proceeds and cigarette tax revenue. In the Master Settlement Agreement from 1998, many US states settled lawsuits against the five largest tobacco companies, which were obliged to pay these states annual payments for recovery of their tobacco associated healthcare costs and to provide restrictions on the sale and marketing of cigarettes. (80)

In 2001, the Coalition for a Tobacco-Free Louisiana (CTFLA) was reformed to advance the state's tobacco control policies. The coalition helped in increasing tobacco taxes in 2002 and 2015/2016. Louisiana's non-profit tobacco control program "Louisiana Campaign for Tobacco-Free Living" (TFL) was created through the 12-cent tax increase in 2002. This led to stronger tobacco control legislation in the 2000s and 2010s in Louisiana; such as local smoking restrictions. In Act 815, the TFL established smoke-free workplaces and public spaces (Smoke Free Air Act) in 2007, Act 211 prohibited smoking on all college campuses in Louisiana and Act 278 (Senate Bill 12) in Regular Session 2014 prohibited the sale of ENDS and vapor pens to persons under age 18 by incorporating e-cigarettes into existing youth access restrictions for traditional tobacco products. However, the minimum age is now raised to 21 under federal Tobacco 21 Legislation. (101)

5.3.4. Actors

Involved actors in proceeding the tobacco increase were representative Harold Ritchie with the original Version of HB No. 119 (Act 94) and other representatives of the House and Senate. Act 94 was signed into law by Governor Bobby Jindal in 2015, but the later hike in 2016 was signed into law by Governor John Bel Edwards. Involved NPO's in developing Louisiana's tobacco control policy were among others the Invest in a Healthy Louisiana Coalition, formed mainly from the Coalition for a Tobacco Free Louisiana (CTFLA), who supported tax increases on cigarette prices by social media campaigns and organizing public events. In addition, the Louisiana Campaign for Tobacco-Free Living played a major role in the tax hike of 2002 and in creating state smokefree legislation. Furthermore, Well-Ahead Louisiana by the Louisiana Department of Health supports tobacco-free initiatives and is doing research on tobacco prevalence, cessation and prevention and prepared the reports "Health Impacts and Taxation of Electronic Cigarettes" in response to House Resolution 155, 2017 Legislative Session by Representatives Hoffman and Leger and House Resolution 109, 2018 Legislative Session by Representative Hoffmann. (9,101)

Again, this study is unable to encompass the entire spectrum of involved actors, as policy-making is a very interdisciplinary process.

5.3.5. Summary

In the following, the results for **Louisiana** will be shortly summarized within the HPT. Louisiana implemented a specific tax for ENDS on nicotine containing liquid as of August 2015 by amending vapor products to Louisiana's statutes and similarly raised the tobacco excise tax in the same year and again in 2016, mainly to generate revenue. The excise tax on other tobacco products differ from the tax rates on ENDS. Sales restrictions to ENDS had been enacted prior to taxing these products and prior to the FDA deeming rule.

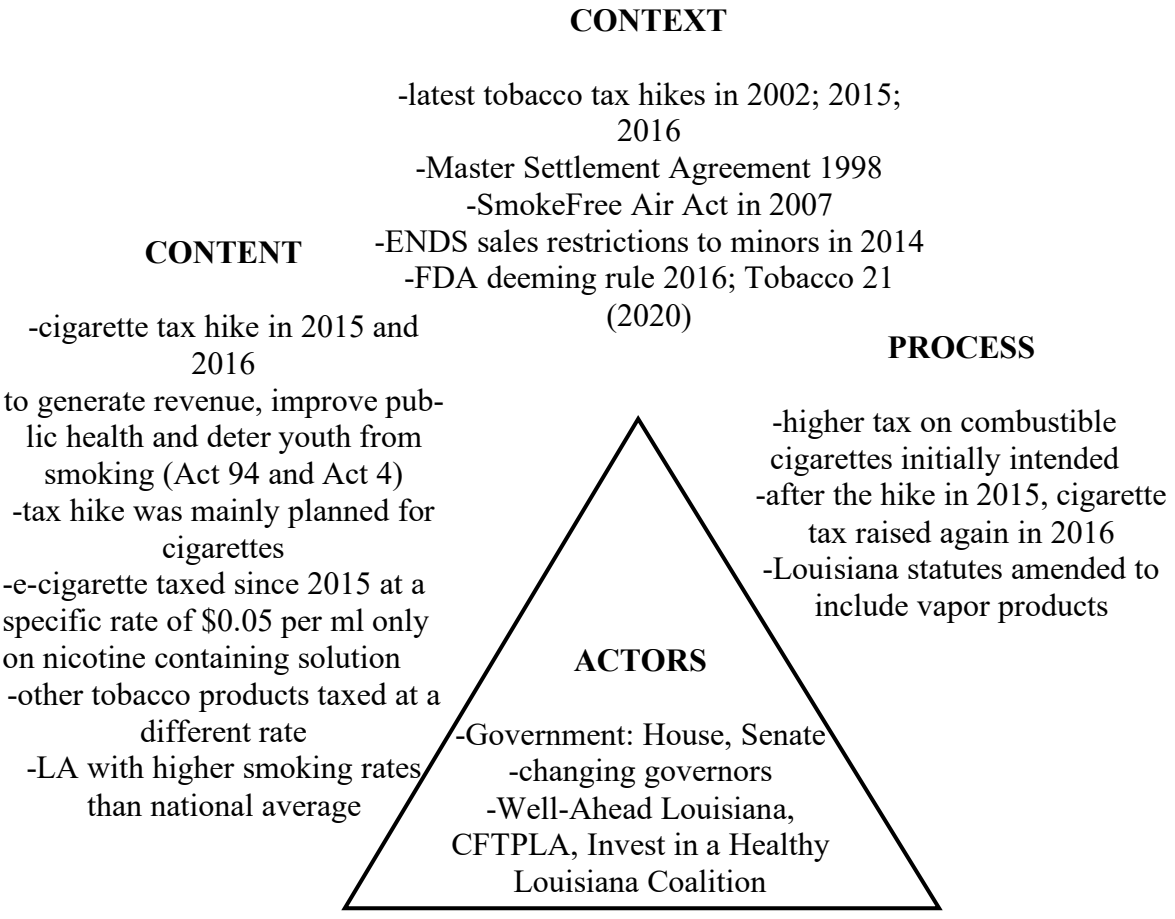

Figure 7 Louisiana Analysis in the HPT

5.4. State Comparison: Results

The main results on the excise taxes levied on a state level will be shortly summarized below. Whereas all US states tax combustible cigarettes at a price per unit shown in table 1, states differ in their ways to tax electronic cigarettes.

Minnesota was the first state to levy an excise tax on e-cigarettes and at the same time on other tobacco products in its "Tic Tac Act" from 2010, implementing a tax ad valorem, which was increased in 2013 with a tax raise on "other tobacco products" as well as a substantial increase for combustible cigarettes. The increased tax of 95 percent of the wholesale price applies to the whole category of "other tobacco products" including cigars, vapor products, pie tobacco, snuff and chewing tobacco defined in Minnesota's statues.[21] At the same time, minimum age for sale of tobacco products was raised and forbidden for minors with the TMCA in 2010.

In contrast, Louisiana defines different tobacco products each individually in its statutes with different taxation methods and heights, leading to a specific tax of $0.05 per milliliter nicotine containing liquid for e-cigarettes. Whereas the taxation on a specific level is administratively easier, Minnesota had to carefully evaluate on which part of the device should be taxed, leading to different treatment for different products, depending of the form in which they are sold. While liquid and cartridges not containing nicotine and reusable/refillable devices are not subject to the tax, cartridges containing nicotine and disposable devices are subject to the tax.

Similarly, overall vaping rates have been increasing in both states especially among minors and young adults, while smoking rates have been declining. However, recent trends in vaping prevalence are difficult to compare, as most states have only recently begun to examine e-cigarette use in their tobacco surveys. Therefore, trend analysis is very limited.

[21] https://www.house.leg.state.mn.us/hrd/pubs/ss/sscigtax.pdf

6. Discussion

Research has shown that price increases are an efficient way to regulate tobacco consumption and that effects are higher especially in price sensitive consumer groups such as young adults and the youth (4,57,58,60,61). Therefore, implementing different taxes on different tobacco products can be crucial for public health concerns in reducing tobacco associated burden of disease. If combustible cigarettes and ENDS are considered substitutes, a price increase of one can lead to an increased consumption of another product. (3,60,61)

Excise taxes influencing one another need to be considered carefully. Different public health strategies in tobacco taxation need to be taken into account evaluating the accurate tax height. Smoking cigarettes has proven to be the leading cause for preventable death and disease in the US. In contrast, ENDS are relatively new products and although Public Health England (1) stated that they are substantially less harmful than conventional cigarettes, clear evidence and long-term studies are still missing to establish the risk associated with vaping.

In Switzerland, ENDS were considered to function as a cessation aid for smokers back in 2011 and were therefor excluded from tobacco taxation and regulated under food law (LMG). (5,19) However, newer research suggests that they function rather as a gateway to nicotine addiction than as a cessation aid, as vaping became increasingly popular especially among high school students and young adults.

In addition, research from MATS suggests that vaping prevalence has been shifting with a majority from being former smokers to never-smokers (86).

For this reason, the right amount of taxation for electronic cigarettes is currently up for discussion at the Swiss Parliament. Switzerland wants to take the likely reduced harm potential of ENDS into consideration when implementing an excise tax for these devices and regulating them under tobacco law (TabPG). (54) As some US states have been levying excise taxes on ENDS for several years now, they could function as a guide on how Switzerland could tax these products.

Since the deeming rule in 2016, the FDA has the authority to regulate ENDS in the US on a federal level. After a substantial increase in US youth using e-cigarettes, the FDA has recently started to regulate these devices more strictly by raising the minimum age of sales for any tobacco product to 21 and restricting available flavours on unauthorized, cartridge-based e-cigarette products. However, the nicotine amount contained in a JUUL pod in the US is much higher than the maximal allowance in Switzerland and Europe.

Despite the long absence of federal laws governing e-cigarettes, currently as of June 2020 more than 20 US states have imposed an excise tax to regulate vaping products. The first state to do so was Minnesota in 2010 with a high excise tax as a percentage of the wholesale price on "other tobacco products" including cigars, vapor products, pipe tobacco, snuff and chewing tobacco with the TMCA. After, many states followed with a wide range of different taxation methods and heights. The aim of the TMCA was to update former tobacco legislation and youth access laws to include newer tobacco products, such as Tic-Tac shaped, candy-like nicotine delivering strips and orbs, which is why the act was also called Tic-Tac act (82). Due to this reform, these "other tobacco products" were taxed at a same rate of 70 percent of the wholesale price, which was later increased to 95 percent, and the sales to minors was forbidden. Unfortunately, no further information could be found on why Minnesota chose to impose a tax ad valorem and why they chose the high percentage on base of the wholesale price. Nevertheless, the findings suggest that Minnesota did not intend to impose the tax only for the reason of e-cigarettes appearing on the US market, but to cover evolving tobacco products in general to which former tobacco legislation did not apply. By the time the tax was levied, ENDS were still relatively unknown, which also may have played a role for later vaping prevalence in the state. At the same time, with the following hike in 2013, the excise tax on combustible cigarettes by 20-pack was more than doubled from $1.23 to $2.83 (and increased again as of January 2017 to $3.04 per pack of 20).

Saffer et al. (3) provided evidence on how taxing ENDS impacts smoking among adults. The authors suggest that the high e-cigarette tax increased adult smoking and reduced smoking cessation rates in Minnesota. They suggest that if states raise cigarette and e-cigarette taxes by substantial amounts at the same time like Minnesota did in 2013, smoking participation will rise. That implies that ENDS are a likely substitute for combustible cigarettes among current smokers and that excise taxes on potentially less harmful vaping devices at relatively high rates risks pushing vapers back to smoking or deterring them to quit.

Therefore, from a point of view where switching from combustible to electric cigarettes is beneficial for public health by reducing harm, Chaloupka et al. (21) propose taxing less harmful products at lower rates to maximize switching to the less harmful products. In contrast, policymakers need to set taxes on these products high enough in order not to encourage uptake among young people and discourage initiation. Young people have shown to be a more price sensitive consumer group, meaning price increases have a higher effect on their consumption.

Louisiana took a different approach compared to Minnesota as another of the earliest US states that started taxing ENDS as of August 2015 with a specific tax of $0.05 per milliliter of nicotine containing liquid. The state revised its statutes and amended them to include further tobacco products such as cigars and “vapor products”, each taxed individually at different rates. The main goal of the revised statutes governing tobacco taxation in Louisiana in 2015 was not only to levy an excise tax on “vapor products”, but mainly to increase the existing per-unit tax on combustible cigarettes. Even though the originally intended hike was much higher than the actual increase, the tax was increased again one year later leading to an excise tax of $1.08 per 20-pack of cigarettes. Nevertheless, cigarette taxation in Louisiana remained below national average. Whereas different sources stated generating revenue because of budget shortfalls as a main goal of the act, the bill was advertised as a public health strategy in order to raise public acceptance (101). In comparison to Minnesota, the taxation of the nicotine containing liquid at a specific rate is administratively easier. Minnesota needed to define exactly which part of the device would be subject to the tax, leading to disparate treatment for different products. ENDS have shown to be a wide product class with evolving products and even evolving sources of nicotine. Lempert et al. (6) therefore advice policymakers to consider broad product definitions and different sources of nicotine. They argue that including ENDS into tobacco control legislation is much easier, allowing regulation under existing law.

The analysis within the scope of this thesis is **limited** by not engaging with the full complexity of state excise taxation. Clear evidence why the compared states chose the taxation method and rate could not be found, nor clear reasons for the policy implementation. Available information was very limited, especially concerning the policy formulation and implementation. Also, the components of Walt and Gilson’s HPT have not been analyzed in depth, especially involved actors, who are difficult to see through.
Moreover, as Minnesota was the very first state to levy a tax on ENDS, there was more available data for this state and less information for Louisiana, which could have biased the state comparison. Furthermore, many tobacco surveys have just recently begun to analyze ENDS in their inquiry, which makes it difficult to analyze trends as a result of state excise taxation.
In addition, further research is needed to evaluate long-term health effects of ENDS and whether they are effective as a smoking cessation intervention. However, the current

ESTxENDS study in Switzerland of the "Berner Institut für Hausarztmedizin" is currently examining vaporizers as a smoking cessation aid in a RCT and might provide further insight.[22] Furthermore, the price is not the only important policy influencing tobacco consumption, as many other have an important role in tobacco control. With the recent stricter federal regulation in the US in order to cope with the "vaping epidemic" (28), raising the minimum age and restricting youth-appealing flavours along with state regulation, future studies might give an insight on how these policies influence US smoking and vaping prevalence especially among young consumer groups.
Challenges further included diverse taxation methods, as most states levy other fees or imply further taxation methods on tobacco products such as Minnesota with its former health impact fee which was repealed with the hike in excise taxation from 2013 and with its use tax owed for cigarette and tobacco products brought into Minnesota from other states to prevent smuggling.[23]

In comparison to the US, Switzerland is lacking behind in its federal e-cigarette regulation, not only concerning excise taxation, but also in marketing, minimum age of sales and smoke-free laws (5,51). ENDS are currently regulated under food law (LMG), but will be subject to tobacco law (TabPG) in the near future (5). After the implementation under TabPG, an excise tax on ENDS is planned. As e-cigarettes are a very diverse product group which is evolving rapidly, policymakers have to consider carefully on what to tax and need to evaluate an appropriate tax rate. Many US states either tax only the liquid or only nicotine containing liquid on base of a specific tax. Other states in contrast chose to tax the device as a whole on base of an excise tax ad valorem or chose mixed systems for open and closed tanks. As e-cigarettes vary widely in their appearance and have been evolving rapidly since their arrival about ten years ago, taxation on a specific level resulted to be administratively easier and is also mostly used in the European Union (4). For this reason, a tax on a specific level of liquid, regardless if it contains nicotine, would be recommended for Switzerland.

Policymakers have basically three different options in levying a tax rate on ENDS based on different levels (21,104); option A) would apply little or no tax on ENDS. This would maximize switching for current smokers, but could lead to increased initiation among young users, could lead to vaping as a gateway to later smoking among former non-smokers and encourage

[22] https://www.uniaktuell.unibe.ch/2018/rauchst_du_noch_oder_dampfst_du_schon/index_ger.html
[23] https://www.revenue.state.mn.us/cigarette-and-tobacco-use-tax

dual use. Option B) would increase taxes on ENDS while maintaining or increasing taxes on combustible products. This could maximize switching from combustible to electronic cigarettes, discourage dual use, vaping initiation and smoking. Option C) would tax ENDS and cigarettes at a similar rate and would discourage youth initiation, discourage dual use and treat all products the same, but would discourage switching from combustible cigarettes to vaping.

To improve public health and tobacco associated burden of disease, reduced risks of tobacco products should be considered when taxing tobacco products, leading to different tax rates for different products with a reduced harm-potential (21).

Therefore, the likely most preferable option would be option B. (21,104) Nevertheless, evidence from Minnesota has shown that e-cigarette tax height needs to be carefully evaluated in order to maximize switching and not to deter current smokers from quitting. The tax rate relatively to combustible tobacco products should be set low enough to encourage smokers to quit, but high enough to discourage initiation by never-smokers leading to potential nicotine addiction and later smoking. As vaping became popular especially among high school students and young adults, deterring the youth from vaping is a major concern. However, to evaluate the appropriate tax rate, further research is needed. If evidence would confirm a reduced harm-potential for e-cigarettes when used over long-term, switching could be encouraged by corresponding tobacco tax policies. In addition, revenues could be used to support tobacco cessation and prevention programs (104).

However, if youth protection was considered as a major concern in e-cigarette regulation, option C) could also be considered by taxing ENDS at a similar level to combustible cigarettes. A tax at a substantial level comparable to conventional cigarettes combined with other restrictions in sales and advertising could deter minors from nicotine addiction and in the long-term from becoming later smokers. Results from the US showed that e-cigarettes have become popular in a very short period of time especially among the youth and young adults and especially among never smokers. For this reason, substantial tax increases could be effective in deterring the youth from becoming vapers and eventually smokers.

Nevertheless, option B) is currently discussed more often by policymakers, acknowledging the probable reduced harm potential of ENDS for current smokers.

Conclusion

The rapid evolution of new tobacco products and the continuous arrival of data regarding safety and health impacts of new products makes it difficult to implement appropriate tobacco

policies (64). In addition, data on long-term safety is lacking. Policymakers could acknowledge the likely reduced harm-potential of newer tobacco products such as e-cigarettes but also Heat-not-burn products and therefore tax them at a lower level than combustible cigarettes. Nevertheless, this does not mean that these products are safe. For this reason, electronic cigarettes could be taxed at a lower rate relatively to conventional cigarettes to maximize the incentives for current smokers to switch from smoking to vaping. However, this often leads to dual use (65). To discourage the youth and young adults from starting to vape and eventually become a smoker, e-cigarette excise taxes should be set high enough to discourage initiation. So, if youth protection was a major goal, a taxation at a similar level to combustible cigarettes would also be an option to be considered. Evaluating an appropriate tax rate is challenging due to various different forms of e-cigarettes and different patterns of consumption among users. If further evidence could be found that e-cigarettes confer lower health risks compared to combustible cigarettes also when used over long-term, encouraging the use of reduced-risk products rather than encouraging complete abstinence of such products could have positive impacts on public health. To reduce tobacco associated burden of disease, Switzerland has to complement different tobacco control policies regulating newer tobacco products especially targeting youth protection such as raising the minimum age of sales, regulating the marketing, packaging, nicotine-content and smoke-free laws in addition to excise taxation relatively to evidence-based product risks.

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Table of Figures

Curriculum Vitae

Name, Vornamen	Merz, Larissa Panida
Geschlecht:	w
Geburtsdatum:	24.09.1992
Heimatort und Kanton	Zürich, Schweiz

Ausbildung:

Primarschule Zürich Riedhof, 1999-2005
Mittelschule Kantonsschule Zürich Oerlikon, Alte Sprachen, 2005-2011

Universität Zürich, 2012-2016
Bachelor of Arts in Soziologie/Recht (120/60)

Universität Zürich, 2016-aktuell
Bachelor und Master of Science in Zahnmedizin